

**ANNUAL REPORT FOR CALENDAR YEAR 2013
USDA ARS**

**National Clonal Germplasm Repository
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**National Clonal Germplasm Repository
Staff**

Permanent/Term Federal Staff

Liz Alperin, Bio. Science Tech., Genetics
Bruce Bartlett, Ag. Science Tech., Plant Distribution
Nahla Bassil, Geneticist – Plants
Jill Bushakra, Research Associate, Genetics
Jeanine DeNoma, Bio. Science Tech., TC
Missy Fix, Bio. Science Tech., Plants
Kim Hummer, Research Leader/Curator
April Nyberg, Bio. Science Tech., Genetics
Jim Oliphant, Bio. Science Tech., Greenhouse Manager
Yvonne Pedersen, Program Assistant
Joseph Postman, Plant Pathologist/Pear Curator
Barbara Reed, Research Plant Physiologist
Joe Snead, Ag Science Tech./Field Manager
Dennis Vandever, Facilities Manager

Temporary Staff and Students

Emily Bouldin, Bio. Science Aid/Field
Jack Brennan, Work Study
Jacob Fought, Work Study
Brad Greenburg, Work Study
Debra Hawkes, Work Study
Andrew Isaacs, Work Study
Tyler Miller, Work Study
Yasmin Moussaoui, Work Study
Brealan Mosieur, Work Study
Rocco, Nguyen, Work Study
Jane Olson, Bio. Science Aid, Greenhouse
Antonio Perez, Work Study
Leonor Rondon, Bio. Science Aid, Field
Kasey Schaefer, Work Study
Frazier Thurman, Work Study
Carly Waddell, Work Study
Jamie Willard, ASE Student
Sky Woods, Work Study
Tyler Young, BENCO



The NCGR staff and associates. (L-R) L. Alperin, J. Olson, S. Poothong, B. Bartlett, S. Wada, C. Waddle, J. Postman, K. Vining, R. Sloop, K. Hummer, M. Das, M. Fix, Madeline, J. Snead, N. Bassil, E. Bouldin, Y. Pedersen, B. Reed, J. Bushakra, J. DeNoma, J. DeNoma, J. Olliphant

Graduate Students and Visiting Scientists

Meleksen Akin, GRA, OSU, Hort., Turkey
Amira Bidani, Fullbright Student/Tunisia
Meera Das, Visiting Scientist/India
Maree Debenham, Visiting Scientist/New Zealand
Charles Hand, GRA, OSU, Hort.
Daeil Kim, Visiting Scientist/Rep. of Korea
Megan Mathey, GRA, OSU, Hort.
Sukalya Poothong, GRA, OSU, Hort. Thailand
Victoria Rivero, Visiting Scientist/Argentina
Natalia Salinas, Fullbright/Ecuador
Sugae Wada, Post Doc. OSU



***Vaccinium virgatum* 'Ethel' in December.**

Stakeholder/Service Accomplishments

- 11,952 accessions, 64 genera and 738 taxa of 645 species of temperate fruit, nut, and specialty crops were conserved.
- Obtained a total of 122 new accessions and 185 new inventory items in CY 2013.
- Obtained new accessions of *Fragaria* (42), *Rubus* (18) and *Vaccinium* (73) from Oregon and from subtropical locations through plant exchange with Botanical Gardens.
- Received 815 new plant requests and shipped 5,147 items in CY 2013.
- 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.
- Provided tours to Slow Food group, Rotarians, Life Long Learning, Master Gardeners and school groups. Trained visiting scientists from China, Korea, Kazakhstan, and California.
- 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.
- Served as co-Chair of a program review panel for the USDA Citrus Genebank, Riverside, CA.
- Participated on Governing Board for USDA National Clean Plant Network.
- Member of the organizing committee and editor of the proceedings for the ISHS 2nd Symposium on Cryopreservation of Plant Species
- Provided assistance to hop breeders for a hop mutation breeding project.
- Trained visiting scientists Ms. Victoria Rivero (Argentina) and Dr. Meera Das (India) for 6 months in cryopreservation techniques.

Research Accomplishments

- Developed the first high throughput 90K genotyping platform in strawberry an octoploid crop.
- Finalized two new pear media, one for scion cultivars (Pear 1 Medium) and one for pear rootstocks (PRS).
- Developed improved microsatellite markers for quince and analyzed genetic fingerprints of more than 100 *Cydonia* and *Pseudocydonia* germplasm accessions.
- Developed “Hazelnut 2013 Medium” by analysis of major and minor nutrients.
- Used 15 polymorphic SSR markers to examine population structure and genetic diversity of black raspberry cultivars.
- Completed analysis of meso and nitrogen nutrients for in vitro raspberry mineral nutrition.
- Used microsatellite markers to determine the genetic diversity and phylogenetic relationships of all clonal medlar (*Mespilus* sp.) accessions in the NCGR germplasm collection
- Analyzed diverse species and cultivars of blueberry fruit for nutritional components such as folate and abscisic acid (an anti-diabetic compound).
- Determined ploidy levels for *Vaccinium* species and related genera using flow cytometry.
- Validated association of an SSR marker with the *Rpfl* gene for red stele resistance in strawberry.

Administrative Overview

Staffing Changes

With attrition and rearrangements in facilities staffing, our federally-supported scientific permanent federal staff members dropped to 10 permanent FTE, two less than the previous year. Five permanent staff members remain retirement-eligible. Our staffing strategy now includes hiring more seasonal helpers and work study students to stretch our salary budget through the year.

Bruce Bartlett, our plant distribution manager, retired at the end of January 2014. He had worked at this task for the past 20 years. Now, Missy Fix is responsible for domestic orders and Jim Oliphant is managing the foreign order shipments. With increasing genetic resource acquisition, more requests, and demands for knowledge base on our collections, remaining permanent staff has taken on multiple responsibilities.

EEO/CR/Outreach

- Through a Research Support Agreement with Oregon State University 1 male and 3 female graduate students were trained. During the winter, 3 disabled high school students (program was funded through local school district grants) were trained in greenhouse management activities.
- During the winter an additional 15 disabled individuals from a local private organization (Work Unlimited) were trained in strawberry greenhouse activities.

Budget

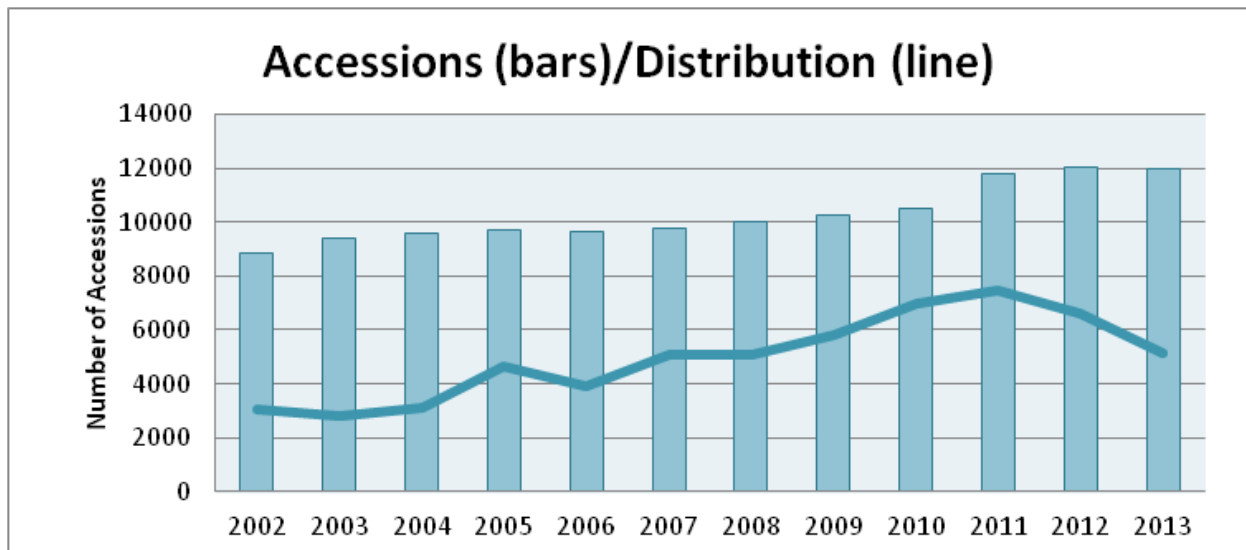
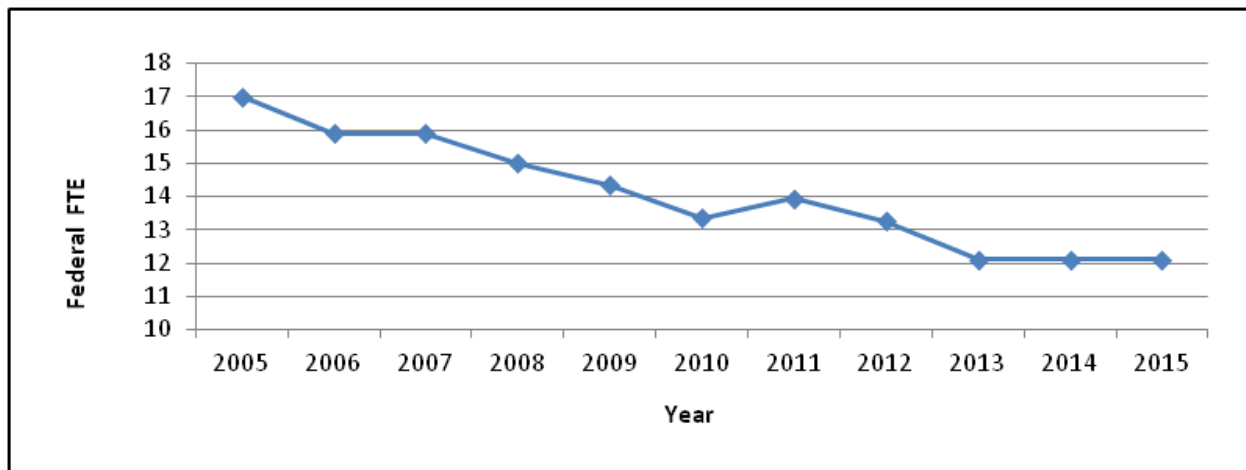
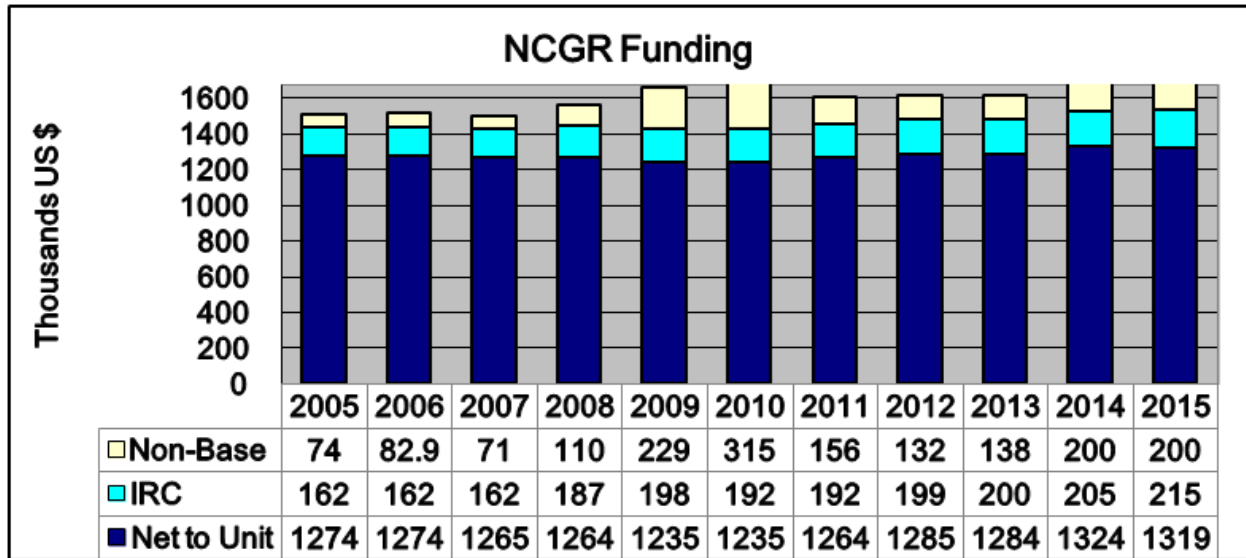
The CY 2013 year was a difficult federal budget year for the NCGR. It included such surprises as a sequester, a budget recession, and a 19-day long furlough. Winter brought on several weeks of “snow days” to delay work activity as well. In addition we were under a travel cap limiting travel to 10% less than our 2010 level.

While our total federal budget has remained about \$1.44 million since 2005 our scientific staff has been encouraged to obtain soft funding

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

FY 2013

Amount	Purpose	Source
127,822	Black Raspberry	SCRI
39,000	Pear rootstock propagation	Washington Tree Fruit Comm.
38,800	RosBreed2015	CSREES
37,000	Pear rootstock propagation	California Pear Commission
30,324	Tissue culture of hazelnuts	Oregon Hazelnut Com.
22,000	Tissue culture of pears	OAN- ODA
10,000	Pear and apricot tissue culture	ISTC-ARS Kazakhstan
9,000	Hazelnut elite selection tissue culture	Oregon Hazelnut Commission
5,000	Hazelnut landscape potential	J. Frank Schmidt Foundation
3,900	Pyrus flow cytometry & tree architecture	NPGS Germplasm Evaluation
1,000	Cold hardy quince rootstock development	Washington Tree Fruit Comm.
323,846	Total	



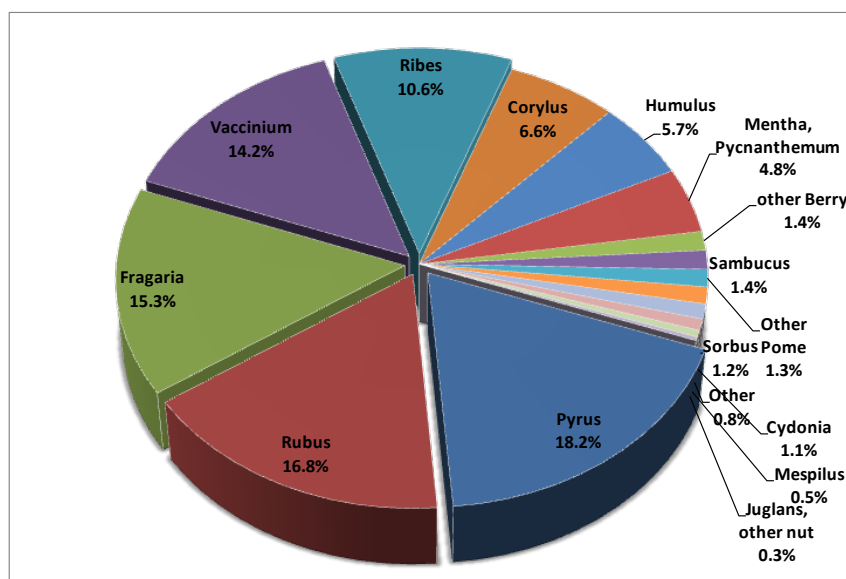
Germplasm Collections

Germplasm Received - Calendar Year 2013

Genus	Accession Records	Inventory Records	Plant Inventories	Seed Inventories
Aronia	1	1	1	0
Chaenomeles	0	2	1	1
Cornus	0	4	4	0
Corylus	12	21	21	0
Crataegus	5	5	5	2
Cydonia	0	1	1	0
Empetrum	9	9	0	9
Fragaria	36	58	42	14
Humulus	2	1	1	0
Mentha	0	1	1	0
Mespilus	1	1	1	0
Pyrus	2	14	14	0
Ribes	0	4	4	0
Rubus	24	33	11	21
Sambucus	9	15	10	5
Vaccinium	18	22	13	9
total	119	192	130	61

Summary of Holdings End of 2013

Genus	Accessions
<i>Pyrus</i>	2166
<i>Rubus</i>	2001
<i>Fragaria</i>	1821
<i>Vaccinium</i>	1690
<i>Ribes</i>	1264
<i>Corylus</i>	784
<i>Humulus</i>	682
<i>Mentha, Pycnanthemum</i>	569
<i>other Berry</i>	168
<i>Sambucus</i>	166
<i>Other Pome</i>	153
<i>Sorbus</i>	146
<i>Cydonia</i>	131
<i>Other</i>	99
<i>Mespilus</i>	59
<i>Juglans, other nut</i>	30



Top Accessions Requested 01/01/2013 to 12/31/2013 for Site COR

Rank	Accession	Taxon	Plantname	Requested	Shipped
1	PI 551842	<i>Fragaria x ananassa</i>	Marshall	27	26
2	PI 557968	<i>Mentha x piperita</i>	Chocolate Mint	27	26
3	PI 618391	<i>Rubus hybr.</i>	Young thornless - Ovenell clone	23	17
4	PI 554802	<i>Vaccinium corymbosum</i>	Dixi	21	4
5	PI 551479	<i>Fragaria x ananassa</i>	Fairfax	20	19
6	PI 617584	<i>Pyrus communis</i>	Joey's Red Flesh Pear	20	19
7	PI 556298	<i>Ribes spicatum</i>	Cherry	19	19
8	PI 617689	<i>Ribes spicatum</i>	White Grape	19	16
9	PI 664467	<i>Fragaria spp.</i>	Strawberry Virus Collection	19	19
10	PI 541271	<i>Pyrus communis</i>	Taynton Squash	15	14
11	PI 552292	<i>Fragaria x ananassa</i>	Variegated Strawberry	15	8
12	PI 617403	<i>Humulus lupulus</i>	Sorachi Ace	15	13
13	PI 502332	<i>Cydonia oblonga</i>	AR-232 - Uzbekistan	14	14
14	PI 559892	<i>Cydonia oblonga</i>	Pineapple	14	14
15	PI 554841	<i>Vaccinium corymbosum</i>	Razz	13	4
16	PI 556357	<i>Ribes spicatum</i>	White Cherry	13	12
17	PI 652507	<i>Lonicera caerulea</i>	Berry Blue	13	8
18	PI 541150	<i>Pyrus communis</i>	Beurre Superfin	12	12
19	PI 541169	<i>Pyrus communis</i>	Dana Hovey	12	12
20	PI 551622	<i>Fragaria x ananassa</i>	Elista	12	9
21	PI 541123	<i>Pyrus communis</i>	Barland	11	11
22	PI 551494	<i>Fragaria x ananassa</i>	Brighton	11	9
23	PI 641280	<i>Pyrus spp.</i>	Ledbetter Pear	11	11
24	PI 285530	<i>Pyrus communis</i>	Johantorp	10	10
25	PI 392320	<i>Pyrus communis</i>	Klementinka	10	10
26	PI 392323	<i>Pyrus communis</i>	Ubileen gift	10	10
27	PI 541119	<i>Pyrus communis</i>	Aurora	10	10
28	PI 541262	<i>Pyrus communis</i>	Seckel	10	10
29	PI 541287	<i>Pyrus communis</i>	Yellow Huffcap	10	10
30	PI 541722	<i>Pyrus hybr.</i>	Ayers	10	10
31	PI 558693	<i>Humulus lupulus</i>	Chinook	10	9
32	PI 617110	<i>Actinidia arguta</i>	Chang Bai Mountain' Giant	10	10
33	PI 652482	<i>Lonicera caerulea</i>	Bluebird	10	3
34	PI 660750	<i>Cydonia oblonga</i>	Champion	10	6

Facilities

This winter we had two separate weeks of freezing snow and ice; one in December 2013 and one in February 2014. During these storms location closures were required due to impassibly snowy roads. The December event caused heating pipes in several greenhouses to freeze and break. Our outside sink and eyewash station just behind the headhouse also froze. Thankfully our intrepid location facilities crew worked overtime to replace the broken pipes and keep our systems up and running. Years like this have convinced us that our “non-hardy” species continue to require greenhouse storage during winter.

We received about \$20,000 funding from our agency for repair of major joists and beams in two of our wooden screenhouse structures. We also repaired our tissue culture growth room environmental controls for about \$5,000.

Security. We upgraded the data bridge to our North farm. Our staff has new smart cards for entering locked doors. A new multi-zone system was installed replacing a 30+ year old system. We installed a new stairway to a storage loft to replace a wooden ladder. We are working with Beltsville engineers for potential replacement of our aging screenhouses with a glass or twin-wall polycarbonate growing structure. If approved, construction is anticipated in 2016.

Travel 2013

Compiled by Yvonne Pedersen

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

Kim Hummer – San Diego, CA; RosBreed & Plant and Animal Genome Meeting; Jan. 2013

Nahla Bassil - San Diego, CA; RosBreed & Plant and Animal Genome Meeting; Jan. 2013

Jill Bushakra - San Diego, CA; RosBreed & Plant and Animal Genome Meeting; Jan. 2013

Barbara Reed – Hood River, OR; Northwest Pear Review; Feb. 2013

Joseph Postman - Hood River, OR; Northwest Pear Review; Feb. 2013

Barbara Reed – Kazakhstan; scientific and education exchange; May 2013

Nahla Bassil – Michigan; RosBREED conference; May 2013

Jill Bushakra – Washington; site visit and evaluation; May 2013

Nahla Bassil – Korea; attending international symposium of Fruit Tree Genomics; June 2013

Jill Bushakra – Missouri; attending Symposium on Eldeberry; June 2013

Barbara Reed – Rhode Island; attending Society for In Vitro Biology meeting; June 2013

Barbara Reed – San Marino, CA; attending and participating in developing cryogenic facility; June 2013

Kim Hummer – Palm Desert, CA; attending Pecan Symposium and ASHS meeting; July 2013

Nahla Bassil - Palm Desert, CA; attending ASHS meeting; July 2013

Barbara Reed – Maryland; attending cryobiology meeting; July/August 2013

Barbara Reed – Ft. Collins, CO; attending ISHS meeting; August 2013

Joseph Postman – South Korea; visiting National Institute of Horticultural & Herbal Science and Rural Development Administration; September 2013

Barbara Reed – New Zealand; attending Global Botanical Congress; October 2013

Visitors in 2013

By Yvonne Pedersen

More than 500 visitors came through the Repository's front door during business hours. Guests arrived in large or small groups, as organized class tours or as individuals. About 61 people attended a blueberry open house in July and another 76 for a pear Open House in August. Groups such as the Oregon Hazelnut Commission, and the Oregon Processed Vegetable Committee used the Repository conference room for their annual meetings. 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 also arranged a tour for 23 summer students to visit the three ARS Corvallis units. International visitors came from India, China, Ecuador, Japan, New Zealand, France, The Netherlands, Finland, Turkey, Thailand, Ecuador, Australia, South Africa, Ireland, England, Canada, and Korea. We also hosted graduate students and visiting scholars from Tunisia, Thailand, Korea, Ecuador, China, Turkey, India, Argentina, New Zealand and Japan.

Tissue Culture and Cryopreservation

By Barbara Reed and Jeanine DeNoma

Research Accomplishments:

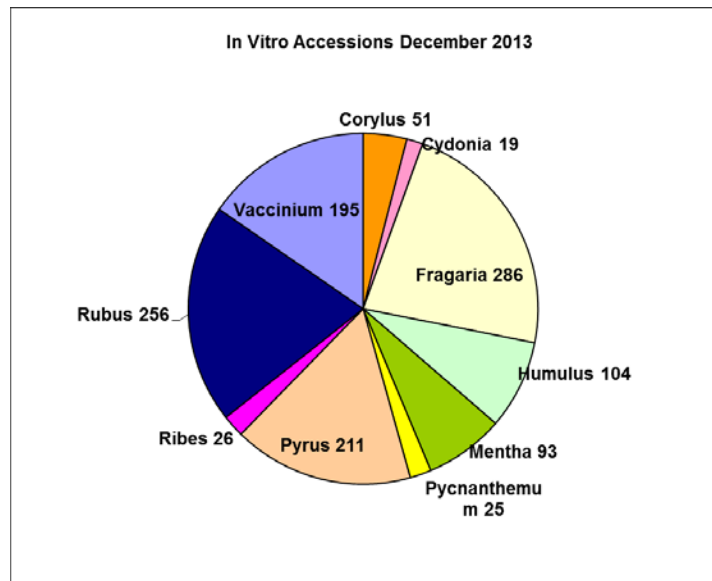
1. Finalized two new pear media, one for scion cultivars (Pear 1 Medium) and one for pear rootstocks (PRS).
2. Developed an interim hazelnut medium (Hazelnut 2013 Medium) after analysis of major and minor nutrients were completed.
3. Completed analysis of meso and nitrogen nutrients required for in vitro raspberry mineral nutrition.

Service Accomplishments:

1. Member of the organizing committee and Editor of the proceedings for the ISHS 2nd Symposium on Cryopreservation of Plant Species.
2. Provided assistance to hop breeder Shaun Townsend for a hop mutation breeding project for several months.
3. Trained visiting scientists Ms. Victoria Rivero (Argentina) and Dr. Meera Das (India) for 6 months in cryopreservation techniques and Ms. Maree Debenham (New Zealand) for 6 weeks on germplasm conservation.

The In-Vitro Collection

The *in-vitro* collection contains mostly the core and other highly requested accessions. Technician Jeanine DeNoma and helpers collected new accessions as plants were available. The spring and summer explanting season resulted in many accessions successfully initiated into culture and cold stored. In December 2013, 1412 accessions were in culture and most were in storage. A graph of the tissue culture collections is shown below. The size of each collection fluctuates over time depending on priorities for distribution and what plants are available for collecting in a particular year. Some plants were lost due to the shutdown in October.



Medium Optimization for Pyrus. We completed a project begun in 2011 to study dwarfing pear rootstock selections and cultivars and to optimize the medium for these important accessions. We optimized the Ca, Mg and P as well as nitrate and ammonium nitrate ratios and developed media that provide excellent growth (Pear 1 Medium). Rooting studies were also completed in 2013. Dwarfing rootstocks are by nature short and slow growing so they provide some additional challenges for culture, but the new medium (PRS) provides the means for good elongation and multiplication from all the cultivars tested. The California Pear Board and the Washington Tree Fruit Commission (Pear section) funded Dr. Reed and Dr. Sugae Wada (OSU Dept of Horticulture) for this project.

Corylus Culture. In June, graduate student Chip Hand completed his MS project to improve *in vitro* hazelnut growth. This project was funded by the Oregon Hazelnut Commission. This study involved culture of advanced selections from the OSU hazelnut breeding program as well as named cultivars. The response of hazelnuts to mineral nutrients was quite different from the pears. There was a greater diversity of optimal mineral combinations required for improved growth. The initial study showed important contributions of nitrogen ratios, increased nitrogen, MgSO₄, KH₂PO₄, and minor nutrients. A second study found many interactions among the minor nutrients and indicated new combinations that provided improved growth. An interim improved *Corylus* culture medium (Hazelnut 2013 Medium) was developed based on these experiments. We will continue with two more series of experiments to further improve the medium and test it on a wider range of hazelnut germplasm.

Raspberry Culture. Ph.D. graduate student Sukalya Poothong is studying the response raspberry cultivars to mineral nutrients. The standard medium is not optimum for many cultivars and she is using the surface response design to develop improved mineral nutrition for five cultivars. The initial experiments found the mesos stock solution (CaCl₂, KH₂PO₄ and MgSO₄) was the most significant limiting factor associated with changes in plant quality, multiplication and shoot length in all cultivars. She has now completed optimization of mesos and nitrogen components and will test a proposed medium on a wider range of germplasm. A metabolomics study to investigate the effects of mineral nutrition on plant metabolism was completed in collaboration with Dr. Claudia Meier, OSU Department of Chemistry.

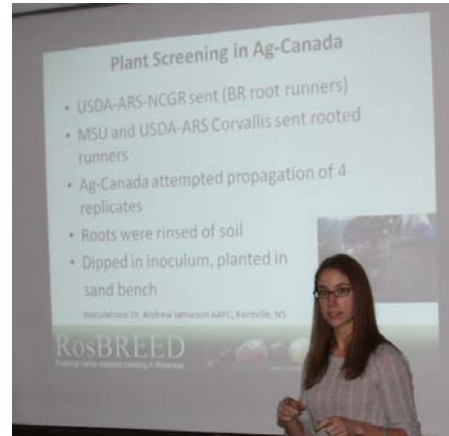
Germplasm Storage by Cryopreservation (Long-Term Storage). Our long-term storage is coordinated directly with Dr. Maria Jenderek of the Vegetative Propagation Group at NCGRP from plant materials supplied by NCGR. The group continues to add to the accessions that are backed up in liquid nitrogen.

Molecular Genetics

By Nahla V. Bassil

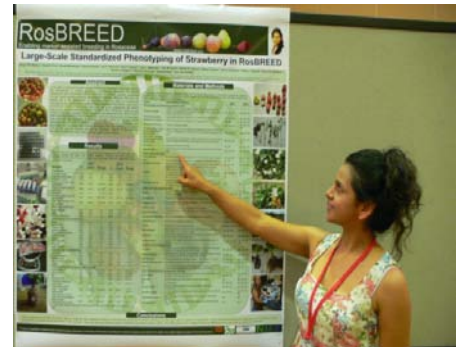
Graduate Students

In collaboration with Chad Finn, Ms. Megan Mathey defended her M.S. thesis and completed two seasons of phenotyping 947 strawberry individuals that include the supercore accessions and ~ 200 NCGR strawberry accessions that are important founders and breeding parents for US breeding programs. In collaboration with Dr. Eric Van de Weg and Dr. Andrew Jamieson, she validated association of a simple sequence repeat (SSR) marker linked to the the Rpf1 red stele resistance gene with the disease response in *Fragaria ×ananassa* by inoculations.



Megan Mathey presents on her Master's Thesis work on phenotyping the diverse germplasm set at the Strawberry Breeders' Workshop co-organized by Nahla Bassil and Chad Finn at NCGR

M.S. student Natalia Salinas started her work on strawberry validating markers associated with remontancy and a marker associated with high soluble solids content. She also implemented genotyping by sequencing (GBS) in octoploid strawberry and will be analyzing the strengths and weaknesses of this technique.



Natalia Salinas presenting a poster at ASHS annual conference in Palm Desert, CA.

Visiting Scientists. Dr. Daeil Kim, Chungbuk National University, South Korea, completed a 17 month visit at the repository where he worked on testing 3 SSR markers believed to be associated with remontancy in strawberry. We have also initiated a project comparing SSR-based fingerprints of Korean pear accessions with the same name accessions maintained at the Corvallis repository. Yoon Kyeong Kim, RDA, South Korea, completed a two month visit to the NCGR where she learned to use the pear fingerprinting set to develop universal genetic fingerprints in pear, screened new microsatellite markers in *Cydonia* and identified a more polymorphic set of SSRs to distinguish accessions that we could not previously distinguish with the 9 SSRs used. She also tested primer pairs reported to be associated with ripening phenotype (storage life, chilling-dependency) in pear.

Projects Completed in 2013

Resolved paternity in the 'Old Home' x 'Farmingdale' rootstock series. 'Old Home' and 'Farmingdale' are two cultivars from Illinois that exhibited strong fire blight resistance and useful horticultural traits. Both became important as interstem stocks and as parents in the development of

new rootstocks. In the 1950s, an Oregon nurseryman collected seed from an ‘Old Home’ tree in British Columbia purportedly pollinated by ‘Farmingdale’ and hundreds of numbered selections of this cross of ‘Old Home’ × ‘Farmingdale’ (OH×F) were evaluated. Several OH×F selections are now valued as rootstocks worldwide, and 45 unique OH×F selections are maintained at the NCGR. Simple Sequence Repeat (SSR) or microsatellite-based profiles were generated for ‘Old Home’, ‘Farmingdale’, 8 OH×F selections, and several reference pear cultivars at NCGR using a standard fingerprinting set developed by the European Cooperative Programme for Plant Genetic Resources. ‘Farmingdale’ is thought to be a seedling of ‘Beurré d’Anjou’. Our study showed that ‘Farmingdale’ shared at least one SSR allele with ‘Anjou’ at each locus tested, confirming this parental relationship. Our studies showed that all OH×F selections shared an allele with ‘Old Home’ at each locus, with one allele carrying a suspected pair of base deletions. However, based on our SSR results, it is impossible for ‘Farmingdale’ to be the pollen parent for any of the OH×F selections examined. Evaluation of the world pear collection at NCGR with this fingerprinting set established the cultivar ‘Bartlett’ as the actual pollen parent of these rootstock clones. Fruit and leaf morphology is also consistent with ‘Bartlett’ and not ‘Farmingdale’ as a parent of OH×F rootstock selections.

Population structure and diversity in wild and cultivated black raspberry (*Rubus occidentalis* L.) evaluated by simple sequence repeat markers. Understanding the structure and diversity of wild black raspberry populations will not only aid in determining the best strategies for germplasm collection, evaluation, and conservation, but may also be used to gauge the potential impact of gene-flow between cultivated *R. occidentalis* and wild populations. We used Bayesian clustering of 15 microsatellite loci to study population structure in black raspberries growing wild at 125 locations across the native range and compare it to 21 black raspberry cultivars. Our analysis indicates that wild *R. occidentalis* populations are highly-structured and well-differentiated from one another on a local level, with significant pairwise differences between all populations. High levels of homozygosity and homogeneity within locations were found, particularly near the edges of the range. Most importantly, 20-30% of the populations surveyed showed strong evidence of being derived, in part, by the dispersal of seed or pollen from cultivated plants. Our findings reflect a breeding system where clonal propagation and self-pollination are dominant, and where the effects of decades of cultivation in proximity to wild plants and appropriate habitats are evident.

Projects in Progress in 2013

Comparison of National Brogdale to Corvallis NCGR pear collections. We used multiplex PCR to fingerprint the NCGR core collection using a universal fingerprinting set developed by the ECPGR. Comparison of the fingerprints of 61 pear accessions in common between the National Brogdale Collection at East Malling Research (EMR) and the NCGR identified 41 accessions with identical fingerprints and 12 accessions with different profiles at 6 of the 12 SSR markers in the fingerprinting set. Six accessions were different at a single SSR locus while 2 accessions were different at two SSR loci possibly indicating differences in genotype scores.

Developing genomic tools for blueberry. As part of an SCRI grant led by Jeannie Rowland, we developed a linkage map for a diploid blueberry mapping population [(Fla4B x W8520) x W85-23]. We identified polymorphic SSRs and coordinated genotyping among collaborators for constructing linkage maps in the tetraploid mapping population of ‘Draper’ x ‘Jewel’. So far, 365 markers were placed across the 12 linkage groups in the tetraploid map and over 200 markers on the diploid map.

SNP markers were developed for this population using genotyping by sequencing and data analyses is in progress.

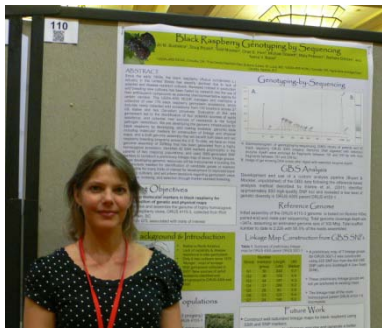
RosBREED: Enabling marker-assisted breeding in Rosaceae. As leader of the genotyping team in an SCRI grant led by Amy Iezzoni (MSU), I led a Strawberry SNP Consortium in weekly teleconferences to develop a 90 K Axiom (Affymetrix) chip as a high throughput SNP genotyping platform for genome-wide scanning in strawberry. We have used this chip to genotype 380 strawberry accessions that included the cultivated strawberry, some of the octoploid progenitors in addition to 24 *F. iinumae* and 3 *F. vesca* representatives. Data analysis is in progress.



RosBREED Strawberry Workshop attendees co-organized by Nahla Bassil and Chad Finn at NCGR, January 31, 2013.

Testing markers associated with remontancy in strawberry. In collaboration with Daeil Kim, Jim Hancock, Chad Finn and Beatrice Denoyes, we are testing three SSR markers linked to remontancy in strawberry in 947 strawberry accessions. The strawberries were also phenotyped for this trait in at least two geographical locations (Corvallis, OR and East Lansing, MI).

Testing markers associated with high soluble solids content in strawberry. In collaboration with Jim Hancock and Chad Finn we are testing an SSR marker linked to high soluble solids content in strawberry in 947 strawberry accessions. The strawberries were also phenotyped for this trait in at least two geographical locations (Corvallis, OR and East Lansing, MI).



Dr. Jill Bushakra presenting preliminary results of genotyping by sequencing of black raspberry at the annual ASHS conference in Palm Desert, CA.

Black raspberry genomic resource development. The USDA-ARS NCGR manages and maintains a collection of over 175 black raspberry germplasm accessions, which includes newly collected wild accessions from 130 locations across 27 US states and two Canadian provinces. Evaluation of this wild germplasm led to the identification of four potential sources of aphid resistance, and potential new sources of resistance to the fungal pathogen *Verticillium dahliae*. We are building the genomic infrastructure for black raspberry by developing, and making available, 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 across the U.S. To date, we have developed over 200 simple sequence repeat (SSR) markers polymorphic in the parents of two crosses and employed the genotyping by sequencing (GBS) method to generate more than 600 single nucleotide polymorphic (SNP) loci. We have used the SSR and SNP markers to construct a linkage map containing seven linkage groups that span approximately 613 centiMorgans (cM). A draft genome assembly of 240 megabase pairs (Mbp) was generated from a highly homozygous accession. The 704 gigabase pairs (Gbp) of sequence generated from seven replicated cDNA

libraries of five different tissue types of 'Jewel' provided more than 30,000 transcription units allowing for structural annotation of the draft genome assembly. Additional aphid resistant crosses have been generated and are in the process of being evaluated. These genomic resources are essential for building the infrastructure needed for identification of candidate genes or closely linked markers for traits of interest during the development of improved black raspberry cultivars, and will inform decisions regarding germplasm value and usage, crossing, and selection through marker-assisted breeding.

NCGR Corvallis Tree Collections

Joseph Postman

Underutilized “Curators Choice” accessions of *Pyrus*, *Corylus* and *Cydonia* with valuable traits such as disease resistance, excellent fruit quality, high productivity, very early fruit ripening or unique historic significance were flagged in the database and promoted to our stakeholder groups. This group of accessions were some of our most requested in 2013.

Pears. The NCGR *Pyrus* collection includes 2239 orchard or screenhouse trees and 333 seedlots representing 36 *Pyrus* taxa from 56 countries. A collection of 200 clones are backed up in vitro as shoot cultures at 40° F, and 340 clones are backed up as small potted greenhouse trees. NCGR presently houses 950 European cultivars, 180 Asian cultivars, 119 hybrid cultivars, 171 rootstock selections, 27 perry (cider) cultivars and 859 trees representing pear wild relatives. Perry pears have been the most-requested genotypes the past several years, and in 2013 the most requested accessions were Joey's Red Flesh Pear, Taynton Squash (perry), Beurre Superfin, Dana Hovey, Barland (perry), Ledbetter, Johantorp, Klementinka, Ubileen Gift, Aurora, Seckel, Yellow Huffcap (perry), and Ayers.

Hazelnuts. The *Corylus* collection has grown to 850 clonal accessions representing 20 taxa from 36 countries. Eastern Filbert Blight (*Anisogramma anomala*) is present nearby, but annual prophylactic fungicide applications have continued to keep the germplasm collection free of this disease. *Corylus* is maintained in a living field collection, with 1 tree per accession. Most field trees are self-rooted, but some are grafted using red-leaf rootstocks to avoid confusion between rootstock suckers and the grafted clone. We are in the process of re-propagating the low-growing, shrubby species *C. americana* and *C. heterophylla* to relocated into dedicated rows so they are not overgrown and shaded by neighboring trees. A grant from the J. Frank Schmidt Foundation allowed us to photograph nut samples and evaluate the collection for landscape potential. The most requested accessions in 2013 were *C. americana* 'OSU 366.088' from Iowa, *C. avellana* 'Fryer Pioneer Hazelnut', *C. avellana* 'Delta' and *C. avellana* 'Jefferson'.

Quince. The Corvallis genebank maintains 174 clonal *Cydonia*, *Pseudocydonia* and *Chaenomeles* accessions and 23 seedlots representing 7 taxa from 17 countries. Quince is very susceptible to the bacterial disease fire blight, however due to the cool temperatures during bloom and dry summers, this disease rarely occurs in Corvallis. However, a few summer rains in recent years have resulted in a number of fire blight strikes.

Quince is grown for the fragrant, edible fruit; as a dwarfing rootstock for pear, and as a flowering ornamental plant. The Repository maintains 22 rootstock clones, and 78 selections grown for their

edible fruit. The most requested accessions in 2013 were AR-232 (early ripening from Uzbekistan), Pineapple, Champion, Bereczki, Aromatnaya Krymsk and Kashenko No. 8.

Summary of Tree Fruit and Nut Collections

Genus	Accessions	Taxa	Countries
<i>Amelanchier</i>	50	11	7
<i>Amelasorbus</i>	1	1	1
<i>Chaenomeles</i>	16	4	5
<i>Corylus</i>	784	21	42
<i>Crataegomespilus</i>	3	1	1
<i>Crataegosorbus</i>	1	1	1
<i>Crataegus</i>	24	9	5
<i>Crataemespilus</i>	1	1	1
<i>Cydonia</i>	131	1	17
<i>Juglans</i>	25	3	3
<i>Mespilus</i>	59	2	12
<i>Peraphyllum</i>	8	1	2
<i>Pseudocydonia</i>	2	1	2
<i>Pyronia</i>	7	1	4
<i>Pyrus</i>	2166	36	62
<i>Sorbaronia</i>	7	4	3
<i>Sorbocotoneaster</i>	3	2	3
<i>Sorbopyrus</i>	11	2	7
<i>Sorbus</i>	146	48	24
total	3445	150	

Greenhouse/Screenhouse

By Jim Oliphant and Missy Fix

- Optimized softwood propagation methods greatly improve rooting success
- Cleaned *Vaccinium* house and replaced benches
- Improved GRIN inventory data and developed a working pot label
- Propagated *Mentha* collection
- Continued the rearrangement of the potted *Vaccinium* collection.

All clonal accessions of *Rubus* are maintained under screen. Accessions from tropical, subtropical, and high latitude habitats are maintained in the greenhouse of which there are now 202 accessions. In 2012, 255 accessions were re-propagated for placement in the collection bringing the total number of accessions to 894 of which 454 are named cultivars. The repository received six new accessions or replacements this year and six new seed lots. Some *Rubus* are difficult to grow in containers indoors and these “*Rubus* of Concern” receive additional care.

Clonal Accessions in Greenhouses and Screenhouses as of March 2013

Genus	Total	Available	Single Plants		
	Accessions	# Acc.	%	#Acc.	%
Actinidia	45	18	40.0	1	2.2
Corylus	18	18	100.0	4	22.2
Fragaria	1580	768	48.6	750	47.5
Humulus	370	190	51.4	171	46.2
Mentha	454	64	14.1	0	0.0
Pycnanthemum	34	34	100.0	0	0.0
Pyrus	324	243	75.0	0	0.0
Ribes	65	58	89.2	8	12.3
Rubus	858	550	64.1	520	60.6
Vaccinium	1090	800	73.4	216	19.8
Other ¹	42	37	88.1	9	21.4
Total	4880	2780	57.0	1679	34.4
1) includes: ASI, CYD, GAY, GAU, MES, SAM			JMO 03/2013		

North Farm Field Operations

By Joe Snead

About 10 acres on the North Farm are planted in germplasm collections, and several other small plots are managed for other scientists at the Corvallis location. Most of the 2012 field budget went to tractor repair and irrigation system repairs. The farm is continuing a program to aid natural predators on the farm for insect and rodent control. We added bird houses and planted perennial and annual flowers to promote the population of beneficial insects.

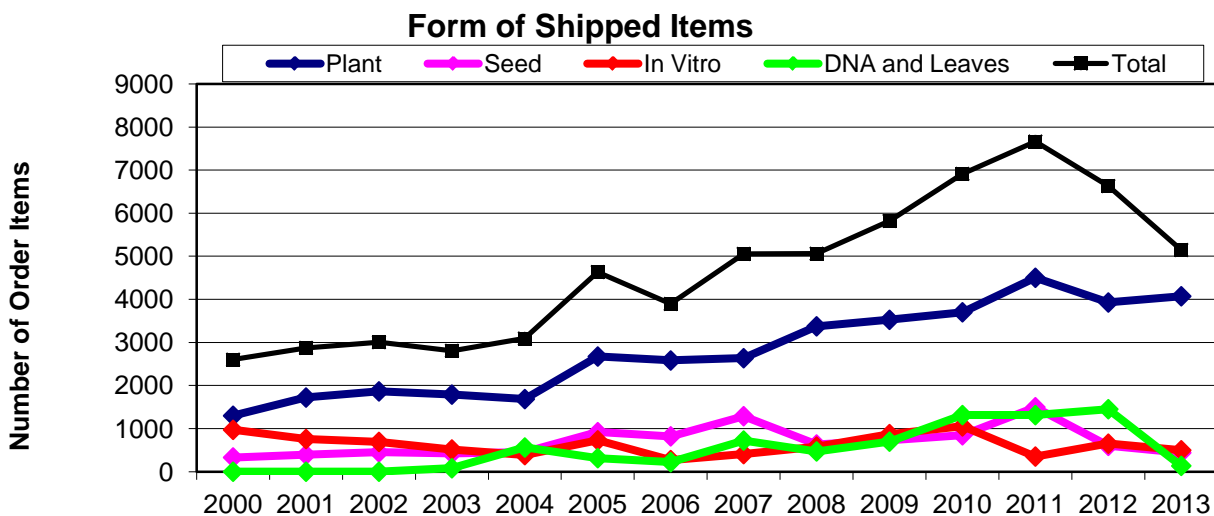
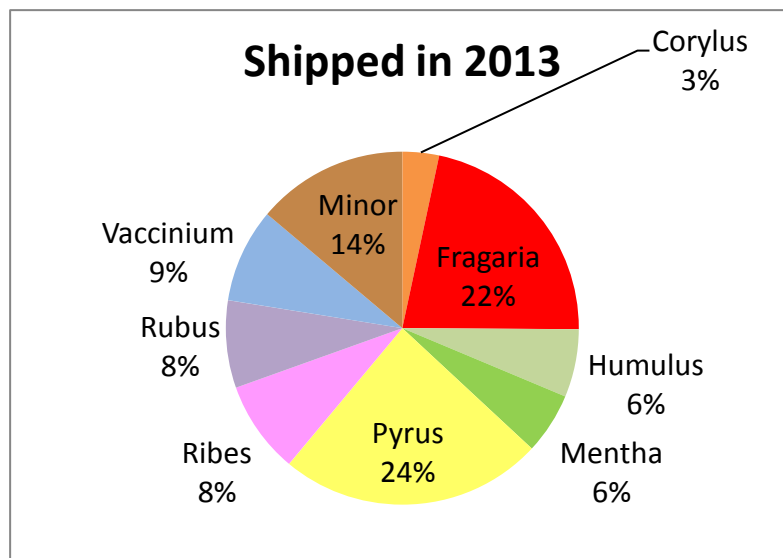
Several North Farm research projects were completed and the plots were restored for future use. The 2.5 acre ARS hop genetics field was removed as well as ornamentals and grape plots. The ground was worked down and left fallow.

Our farm equipment is aging and requires frequent repairs as they age. Repairs can easily surpass budget spending limits and it can be difficult to find parts for the oldest tractors. The main irrigation well needed to be back flushed to get the flow back in mid-July and we greatly appreciate the financial assistance from Area and Headquarters for this repair to our irrigation system.

Distribution

by Kim Hummer and Missy Fix

- In CY 2013, NCGR staff shipped 5,147 items as seeds, cuttings, runners, scionwood, rooted plants, tissue cultures and DNA and leaf samples.
- In CY 2013, 815 new orders were received and more than 770 orders were shipped.
- The pears and strawberries topped the list of crops distributed.
- Domestic individuals, state agencies and universities, and ARS researchers received the most germplasm from Corvallis in 2012.



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