PGOC, NRSP-6, and Regional Plant Introduction Stations Update

Gan-Yuan Zhong
USDA, ARS, Plant Genetic Resources Unit
Geneva, NY

Plant Germplasm Operations Committee

- About 50 people attended the last PGOC meeting which was held from October 28-31, 2014 at Davis, California

- International visitors: Dallas Kessler and Axel Diederichsn from Canada, Wang Shuming, Xin Xia and Lu Xinxiong from China, Luz Barrero from Colombia, Thomas Payne from CIMMYT.

- Reports from ONP and various NPGS functional groups and subcommittees

  - ✓ Office of National Programs Report – Peter Bretting
  - ✓ USDA National Germplasm Resources Lab, Plant Exchange Office – Gary Kinard and Karen Williams
  - ✓ USDA National Laboratory for Genetic Resources Preservation – Stephanie Greene and Chris Walters
  - ✓ GRIN Global update – GRIN Global team
  - ✓ NPGS Order Processing Challenges – Gary Pederson
  - ✓ NPGS Regional Plant Introduction Station Updates – Candy Gardner (Ames, IA), Gan-Yuan Zhong (Geneva, NY), Gary Pederson (Griffin, GA) and Clare Coyne (Pullman WA)

Plant Germplasm Operations Committee

- Reports from ONP and various NPGS functional groups and subcommittees
  - ✓ Operations Manual update – Kim Hummer
  - ✓ Acquisitions & Distributions – Karen Williams
  - ✓ Molecular Markers in GRIN – Gayle Volk and Chris Richard
  - ✓ Updating "Seeds for Our Future" brochure, Phytosanitary and Shipping – Gary Kinard
  - ✓ GIS and Georeferencing, Crop Wild Relatives – Stephanie Greene

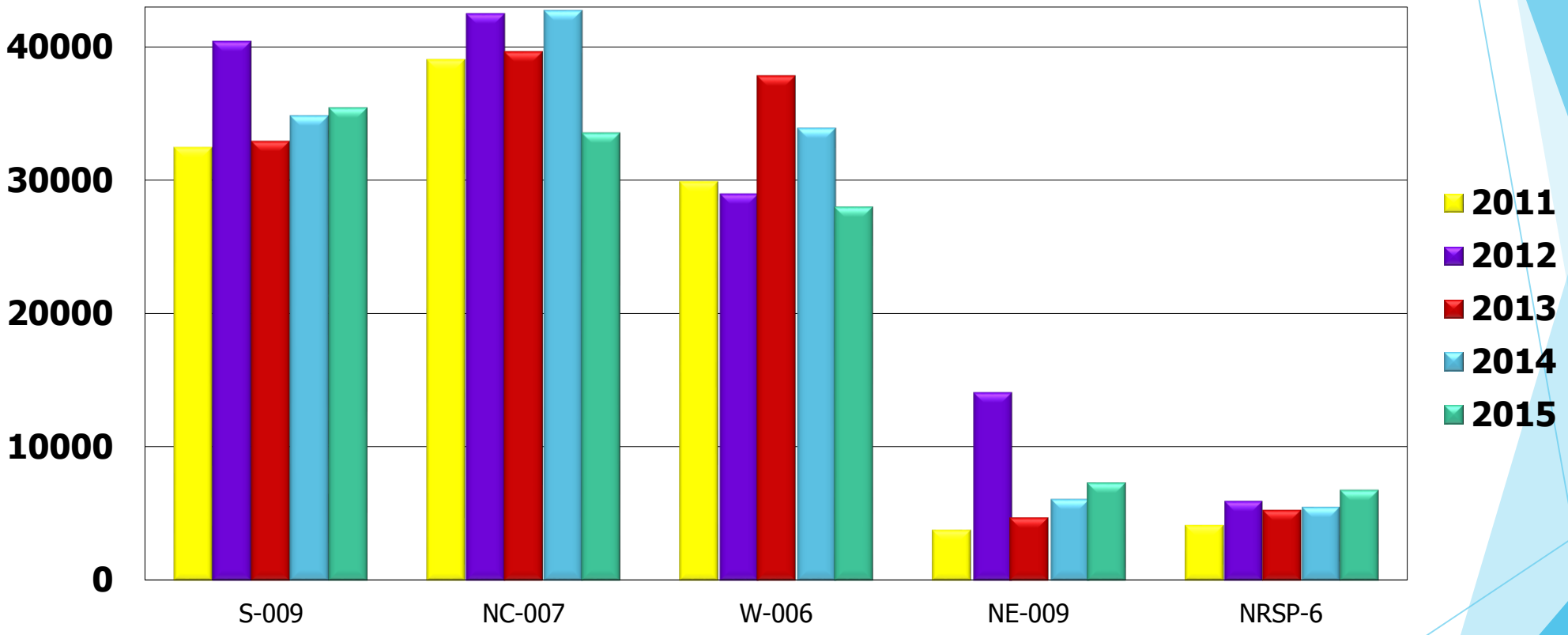
- Critical and Emerging Issues
  - ✓ Balancing Conservation and Research
  - ✓ Cat 4 promotion
  - ✓ Better outreach and public awareness
  - ✓ Economic impact of our collection and acknowledgement of our material and contribution
  - ✓ Guidelines for decommissioning NPGS collections
  - ✓ Proprietary, genetically enhanced, and x-PVP in NPGS
  - ✓ Crop vulnerability statement

- Next PGOC meeting in Ft. Collins, CO

US Regional Plant Introduction Station Functions

- Acquire, conserve and distribute plant genetic diversity and associated information
- Encourage use of germplasm (User-focused)
- Conduct research to improve genetic resource management programs
- Evaluate and characterize germplasm to facilitate targeted research objectives
- Prebreeding activities to facilitate utilization

Distributions



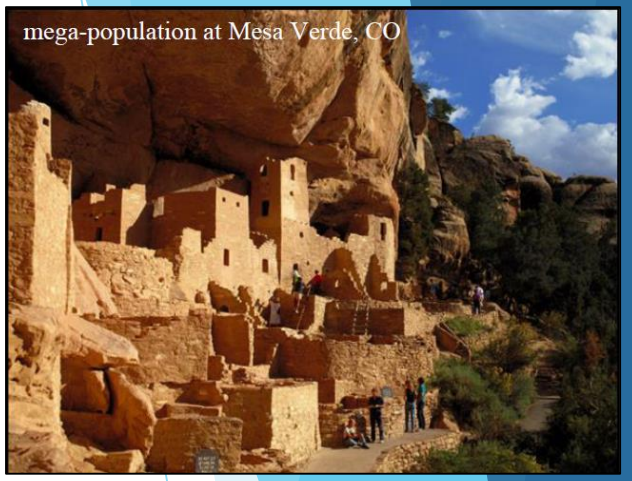
About 120,000 accessions and genetic stocks have been distributed annually by 4 PI and the NRSP-6 Stations in the last 5 years

Potato Genebank (NRSP-6)

- Preservation, evaluation and distribution of 5,000 botanical seed accessions of about 100 species; 1,000 in vitro clones are also preserved.
- Collected 17 new germplasm collections from Arizona and received 3 new cultivars and breeding clones from cooperators in 2015.
- Increased 231 accessions as botanical seed populations and 2,928 accessions as clones.
- Carried out virus tests on 1241 accessions, germination tests of 1532 accessions, and ploidy determination of 26 accessions.
- Distributed a total of 11,392 accessions in 2015, including 10,789 domestically and 603 internationally.

Potato Genebank (NRSP-6)

- Classification of core collections, new "cog" technique and SNP fingerprinting of most accessions.
- Testing new inbred diploid breeding method for *Criolla* (egg yolk) style speciality potato.
- Used AFLP to find an in *situ population* with 82% of the species' total diversity
- Produced first proven and available hybrids with *S. jamesii,* a species with many valuable traits.
- Cooperative research finds strong resistance to Zebra chip vector
- Bred new cultivar for Peruvian altiplano with local cooperators

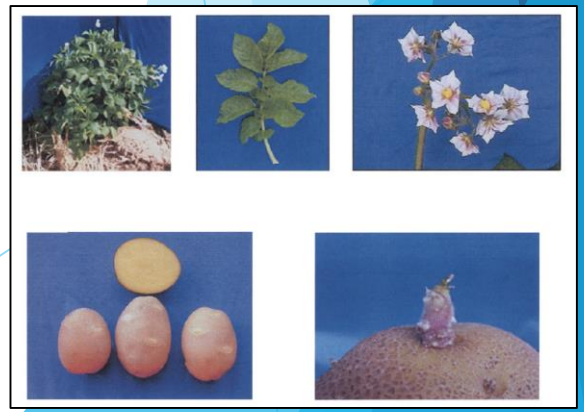


Potato Genebank (NRSP-6)

- **Impact of NRSP-6 on potato industry:**

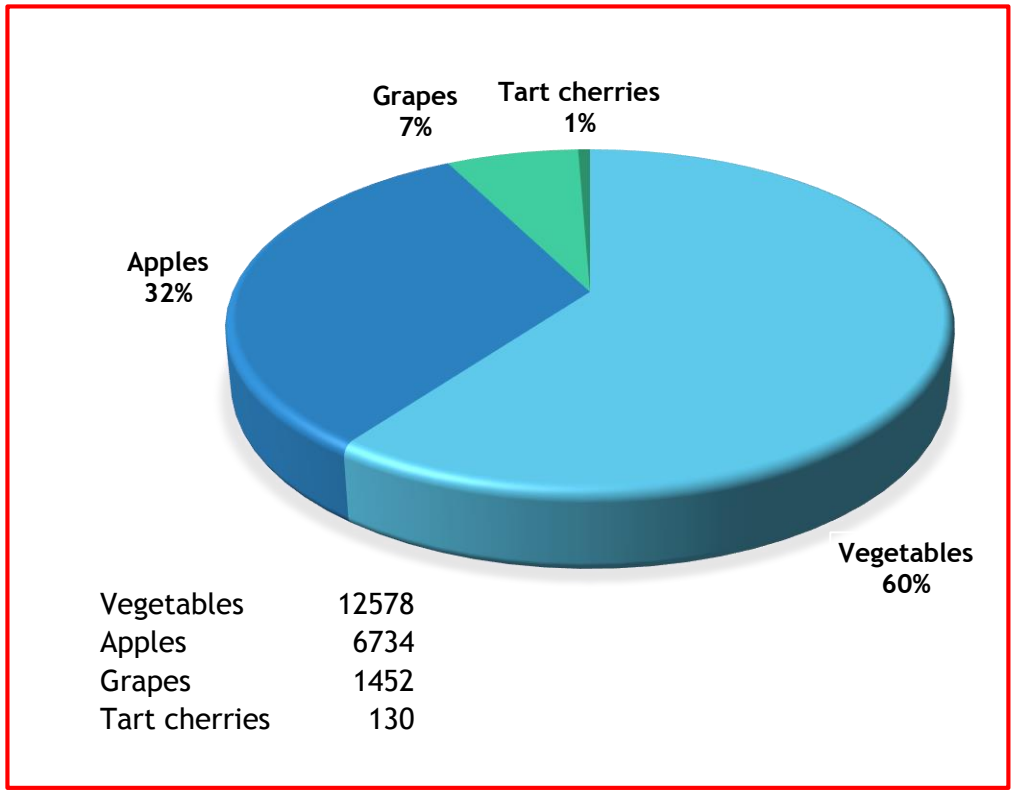
Discovering and deploying traits: better selections for golden flesh, frost and drought resistance in Peruvian highlands, increased folate, resistance to tuber greening, big-tuber wild species mutants.

NRSP6 exotic germplasm in the pedigrees of many new cultivars and published germplasm releases this year: BR3, BR5, BR85, Sierra Rose, Peter Wilcox, Simplot Innate intragenic cultivars.



North-Eastern Regional (NE-009)

➢ Crops managed



Vegetables	12578
Apples	6734
Grapes	1452
Tart cherries	130

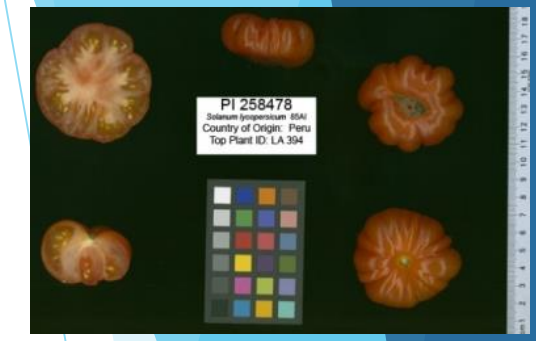
➢ Two curatorial programs:

- ❖ Vegetable Crops (**Larry Robertson & Joanne Labate**) tomato, onion, radish, winter squash, cabbage, cauliflower, broccoli, other cole crops, celery, tomatillo, asparagus, buckwheat and other vegetables.
- ❖ Clonal Crops (**Thomas Chao & vacant position**) apples, grapes and tart cherries.

North-Eastern Regional (NE-009)

Highlights:

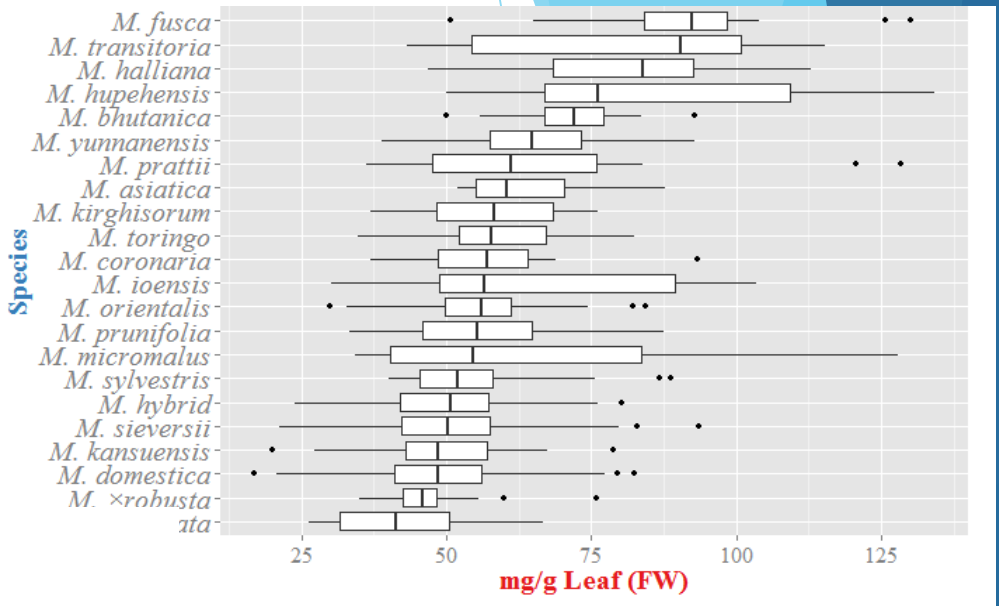
- Distribution of 36,850 clonal and 36,463 seeds = 73,313 germplasm samples (13,992 in 2015) from 2011 – 2015.
- Establishment of 2,126 regeneration plots (420 in 2015) for seed production of vegetable germplasm to distribute and replenish stocks from 2011 – 2015.
- Genotypic data for hundreds of samples each of *Vitis*, *Malus*, tomato, *Brassica rapa*, onion, radish, and winter squash will help to quantify diversity and relationships for germplasm collections.
- Genetic analysis of highly apomictic *Malus hupehensis* using RosBreed 9K chip
- RNA-Seq transcriptome analysis of survivability of *Malus* in cryo-preservation treatment
- Plant exploration in southern US added 37 seed accessions of *Malus angustifolia* and two seed accessions of Muscadine grape.

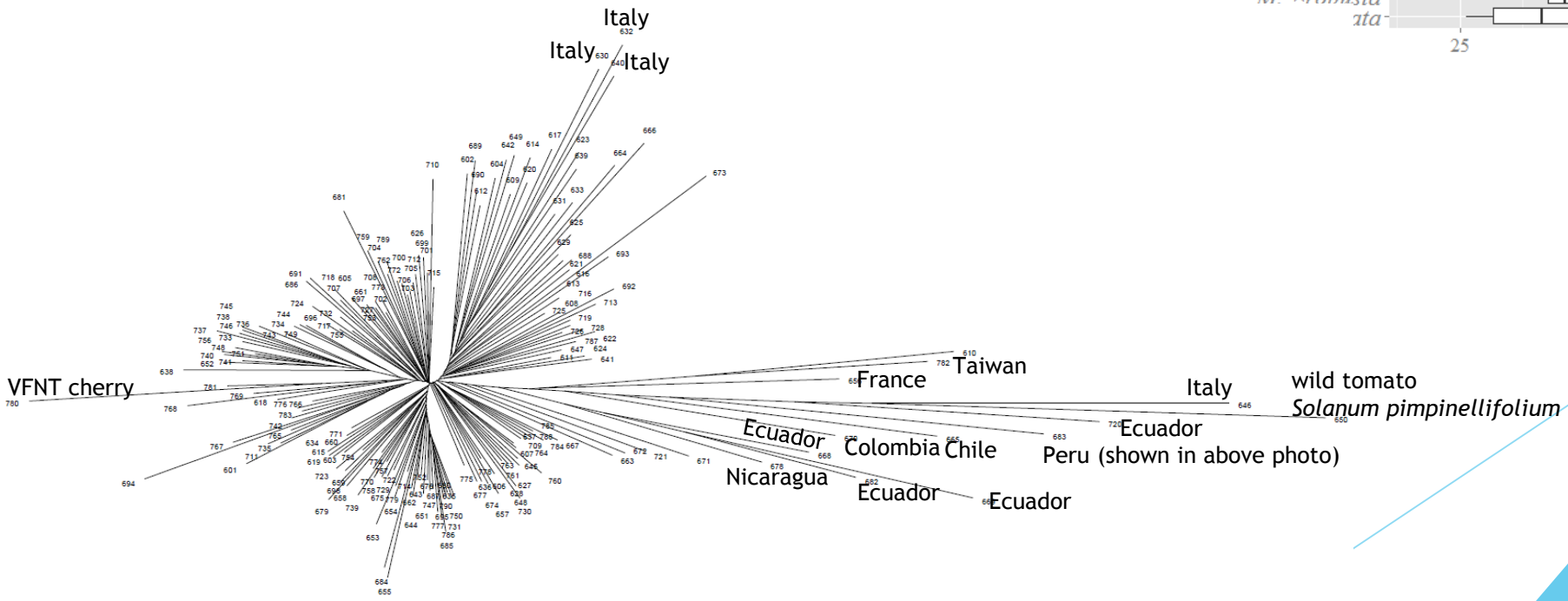


North-Eastern Regional (NE-009)

Highlights:

- Phloridzin in *Malus* collection was surveyed for 345 accessions from 45 species and species hybrids (right).
- NPGS core collection of 190 tomato accessions characterized using genotyping-by-sequencing (below).





North-Eastern Regional (NE-009)

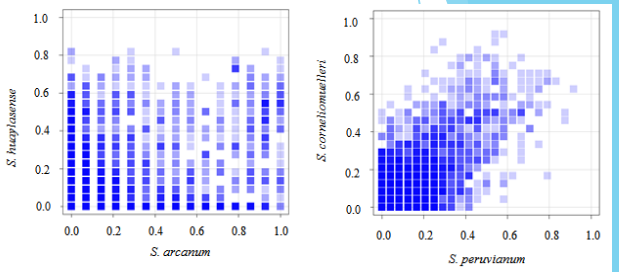
Highlights:

- *Malus* collection was surveyed for accessions that show favorable potential for apple cider production based on fruit traits.

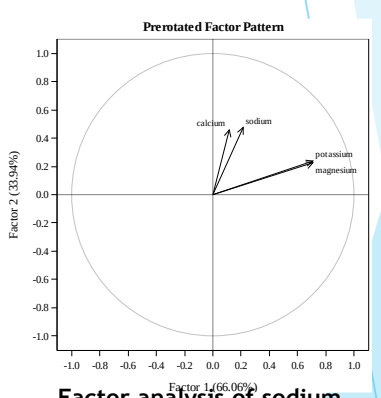
- A genetic basis for mineral nutrients (potassium, magnesium, calcium and sodium) was observed for tomato accessions and will provide insight for development of cultivars with good fruit quality and health-beneficial properties.

- *Brassica rapa* accessions were grown in a field trial in 2015. Genome-wide association studies (GWAS) will be used to associate SNPs with traits including glucosinolate and ion profiles.

- Northern Organic Vegetable Improvement Collaborative (NOVIC) activities are providing organic farmers with new vegetable cultivars adapted to northern climates.



Contrasting allele frequencies for pairs of wild tomato species

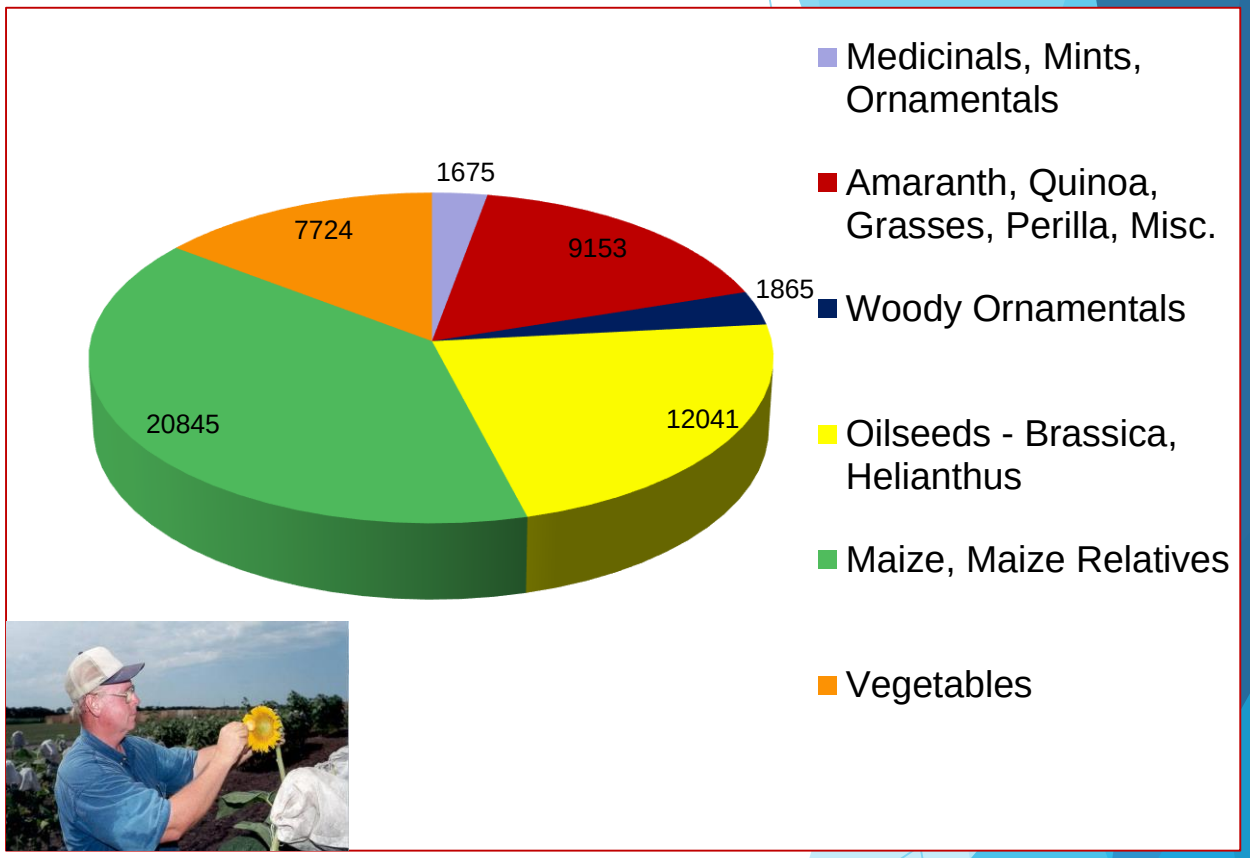


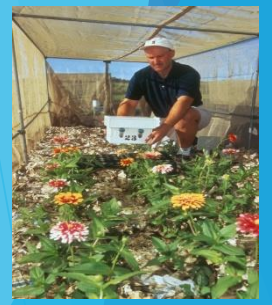
Factor analysis of sodium, potassium, magnesium, calcium content of tomato accessions

NOVIC seed cleaning demonstrations and outreach

North Central Regional (NC-007)

- Strategic collection development
- Maintain and provide high quality, true to type, well-documented germplasm for research and education objectives for primarily heterogeneous, heterozygous, out-crossing crops
- Pollinator insect management program provides six insect species on demand to support regenerations
- Characterization and evaluation to increase collection usefulness
- Provide technical expertise for completion and deployment of GRIN-Global. Facilitate interoperability of various information resources.





North Central Regional (NC-007)

- Focus on Development and Implementation of GRIN-Global

1. Software developer embedded with curatorial personnel provides expertise to create wizards, peripheral applications, and enhancement of Curator Tool functions
2. Maize curator serves as business analyst, and personnel devoted to testing and training
3. Partnership with the Database Management Unit to achieve NPGS objectives
4. Iterative development to address issues identified by testers and system users
5. Use of an array of virtual servers and other technologies for robust testing of beta versions

- Assist users with workflows and tools

1. Participation in GRIN-Global Advisory Committee to develop system-wide thinking and collaboration to improve and evolve the GRIN-Global System
2. Technical exchanges with institutions such as CIMMYT

North Central Regional (NC-007)

- Collection Development Activities

Among many factors to consider, the importance of the species and risk of habitat loss or extinction take priorities.

1. Continued collection of wild *Helianthus* (sunflower) across its native distribution; ornamental focus on *Fraxinus*, *Cornus*, *Gymnocladus* and other native plants; expired Plant Variety Protected maize and tropical x temperate introgression lines; vegetable crop wild relatives

2. Conserving Ash Tree Germplasm for Future Re-establishment (threatened by the emerald ash borer); comprehensive collection of all native species across their range for the past 11 years.

North Central Regional (NC-007)

- Seed Health Testing and Capacity Development

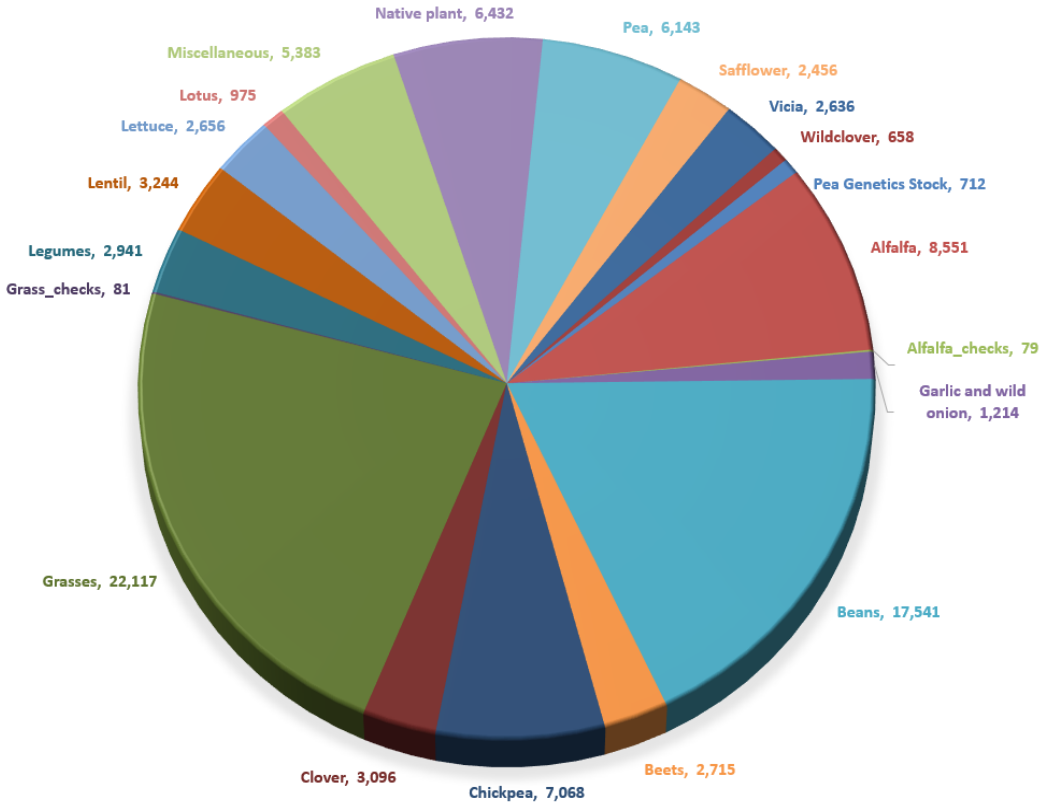
1. Seed health testing to support international seed shipment (primarily maize and sunflower)
2. Development of seed health assays that can be utilized to assure seeds meet phytosanitary requirements for distribution – *Pantoea stewartii*, *Acidovorax avenae*
3. Characterization of tropical *Pantoea* isolates that cause false positives when testing maize seed for the Stewart's wilt pathogen, *Pantoeae stewartii*, via ELISA methods. False positives → failure to obtain phytosanitary certificates→ distribution not allowed
4. PCR methods development for A. avenae infestation of melon seeds
5. Screening of all cucurbit seedlings for Squash Mosaic Virus via ELISA

North Central Regional (NC-007)

- Viability Research
  - Culmination of three year effort by Horticulturist on *Actea* and *Hypericum* sp.
    - Seed dormancy breaking
    - Viability assays
    - Germination methods development
  - 10 year determination of effects of storage conditions on *Calendula officinalis* germination, part of a long-term study

Western Regional (W-006)

Crops managed



Total number of accessions is 96,698 as of May 20, 2016

Five curatorial programs:

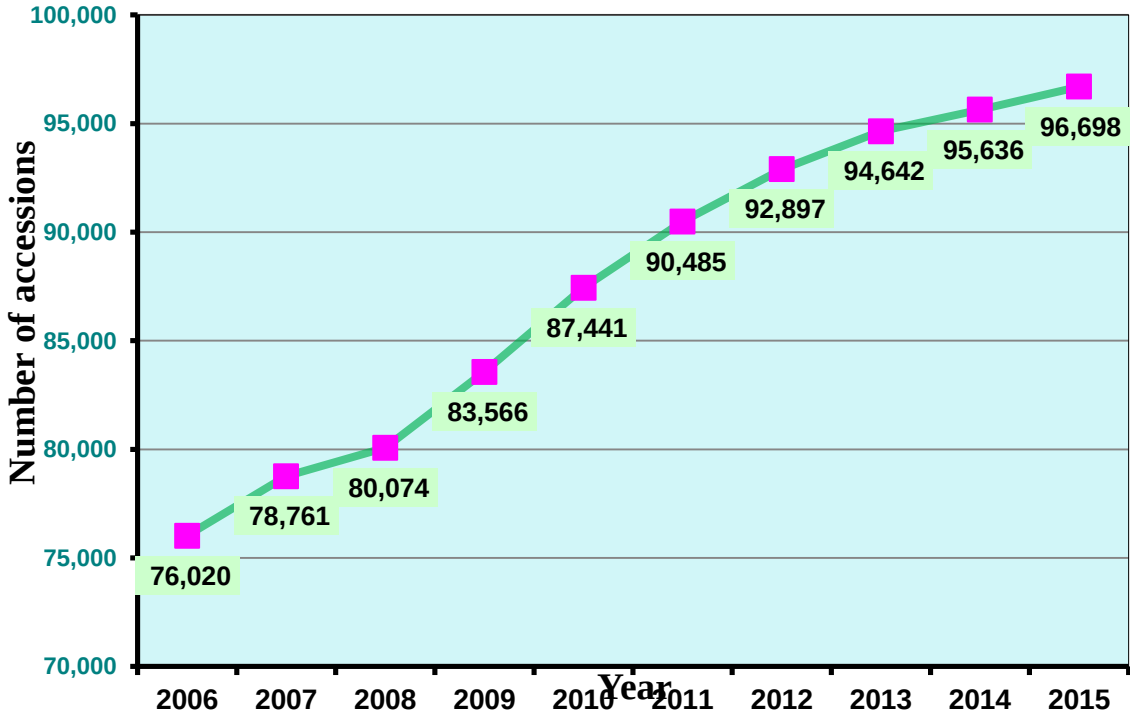
1. Agronomy and grasses (**Vicki Bradley**)
2. Beans (**Theodore Kisha**)
3. Cool season food legumes (**Clare Coyne**)
4. Temperate forage legumes (**Brian Irish**) located in Prosser, WA
5. Horticultural and miscellaneous crops (**Barbara Hellier**)

Four research programs:

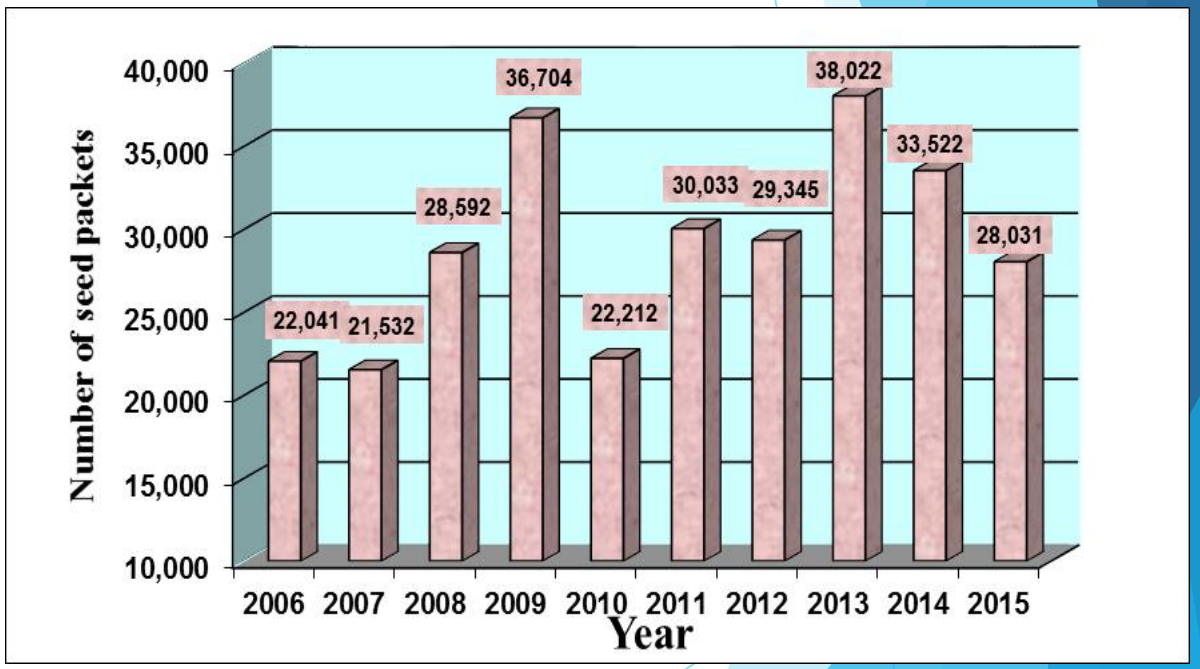
1. Agronomy (**Richard Johnson, retired**)
2. Plant pathology (**Frank Dugan**)
3. Genetics (**Jinguo Hu**)
4. Genetics (**Long-Xi Yu in Prosser, WA)**

Western Regional (W-006)

Changes of total number of accessions managed by WRPIS in the past ten years



Number of seed packets distributed by WRPIS in the past five years



Western Regional (W-006)

Highlights:

- As of December 31, 2015, 97,263 accessions belonging to 1,131 genera, 4,994 species and 5,689 taxa are preserved.
- Acquired 1,908 new accessions including 1,631 native plant accessions from the SOS (Seeds of Success) project.
- Distributed 28,031 packets of seed samples to 1,171 requestors with addresses in each of the 50 domestic states and 42 foreign countries. Seventy-two percent (20,144 packets) were distributed to the U.S. and twenty-eight percent (7,887 packets) were distributed to foreign countries. Requesters in each of the 50 domestic states received germplasm samples from WRPIS in the Year of 2015.
- Uploaded 13,581 observation data points on 3,947 accessions into the Germplasm Resources Information Network (GRIN)-Global database, which is accessible by researchers worldwide via the internet. These data points are on 169 established descriptors of 10 different crop species. WRPIS staff collected 91% of the evaluation data points and our collaborators contributed 9%.

Western Regional (W-006)

Highlights:

- Packed and stored 1,213 newly regenerated/harvested inventories of a broad range of plant species. We determined seed quantities of 15,728 inventories.
- Shipped 2,805 seed inventories to the National Laboratory for Genetic Resources Preservation, Fort Collins, Colorado and 5,117 inventories to the Svalbard Global Seed Vault, Svalbard, Norway for secured backup.
- Published three seasons of data regarding relative susceptibility of numerous germlines of Great Basin wild rye to stripe rust (*Puccinia striiformis*). Resistant and susceptible germlines are identified.
- Released four winter hardy faba bean germplasm lines after selection over five consecutive winter seasons for pulse and cover crop development.

Western Regional (W-006)

Personnel Changes:

New Hire:

Dr. **Brian Irish**, who started on January 17, 2016 as the Geneticist/Curator of the Temperate Forage Legume Germplasm Collection located in Prosser, WA;

Mr. **James Dann**, who started on March 20, 2016 as the Program Support Assistant;

Ms. **Jessy McGowan**, who started on April 3, 2016 as a Biological Science Technician for the Agronomy curator.

Ms. **Dawn Tachell**, who started on March 20, 2016 as a Biological Science Technician for the Phaseolus Bean curator.

Mr. **Britton Bourland**, who started on March 6, 2016 as a Biological Science Technician for the Cool Season Food Legumes curator.

Retired:

Research Agronomist **Dr. RC Johnson** retired in April 30, 2016. This position was abolished.

IT Specialist **Ms. Gwen Pentecost** retired in May, 2016. This position will be re-filled.

Western Regional (W-006)

Various germplasm management and research activities

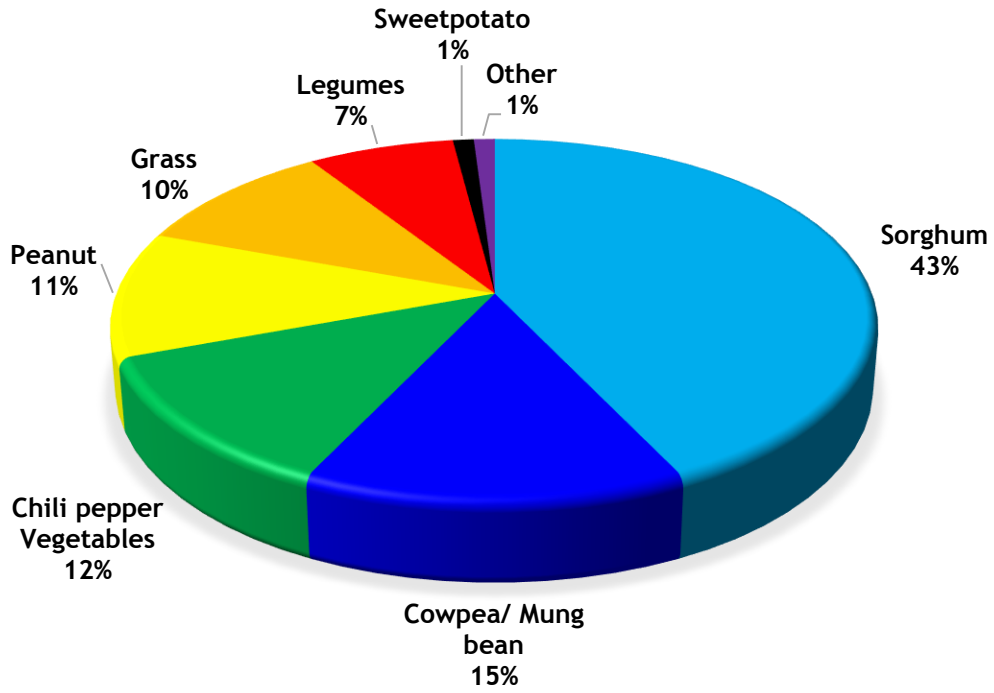







Southern Regional (S-009)

Crops managed



Curators and Scientists

- Sorghum and annual clovers
  Gary Pederson
- Warm-season grasses
  Melanie Harrison
- Chili pepper, watermelon, sweetpotato, vegetables
  Bob Jarret
- Vigna & misc. legumes
  Brad Morris
- Peanuts
  Shyam Tallury
- Genetic research
  Ming Li Wang

Southern Regional (S-009)

Highlights:

- S-009 collection had 92,215 accessions of 1,579 species with 90% available for distribution.
- 98% of the collection is backed up at Ft. Collins, CO, and 14% is backed up at Svalbard, Norway.
- 35,376 accessions were distributed in 940 orders to users in 45 states and 40 countries in 2015.
- Germination tests, started in Griffin in 2002, have now been conducted on 83,964 accessions or 92.4% of the collection. Only 15% of seed samples available for distribution have viability less than 50%, while 58% of seed samples available for distribution have viability greater than 75%.

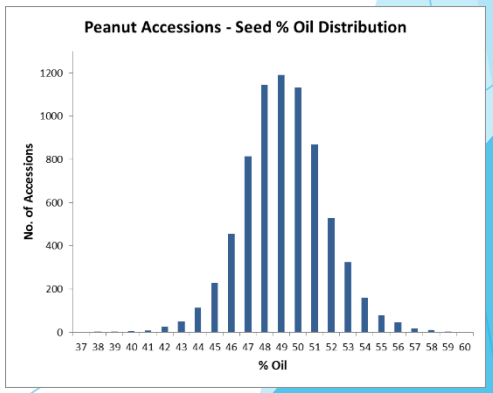
Southern Regional (S-009)

Highlights:

- For improved seed longevity, bulk seed of accessions (85% of collection) are stored in -18C freezer storage.

- Moveable storage shelves have now been installed in all five 4C and -18C seed storage cold rooms at Griffin to maximize seed storage capacity.

- Seed oil content and fatty acid composition has been determined for most accessions in the peanut collection. Two accessions with 80% oleate content and the mutation responsible for this increased oleate content were identified.



Southern Regional (S-009)

Personnel Changes:

- Shyam Tallury was hired as the new peanut curator on Nov. 1, 2015.
- Lew Hunnicutt was hired as the Griffin Campus Director and Assistant Provost on Nov. 1, 2015, in the position previously held by Jerry Arkin.
- Gary Pederson will be retiring as Research Leader, annual clover curator, and acting sorghum curator on Jan. 3, 2017. Dr. Pederson was a previous NPGCC member (2010-2013) and has served as Research Leader at Griffin since 2001.