

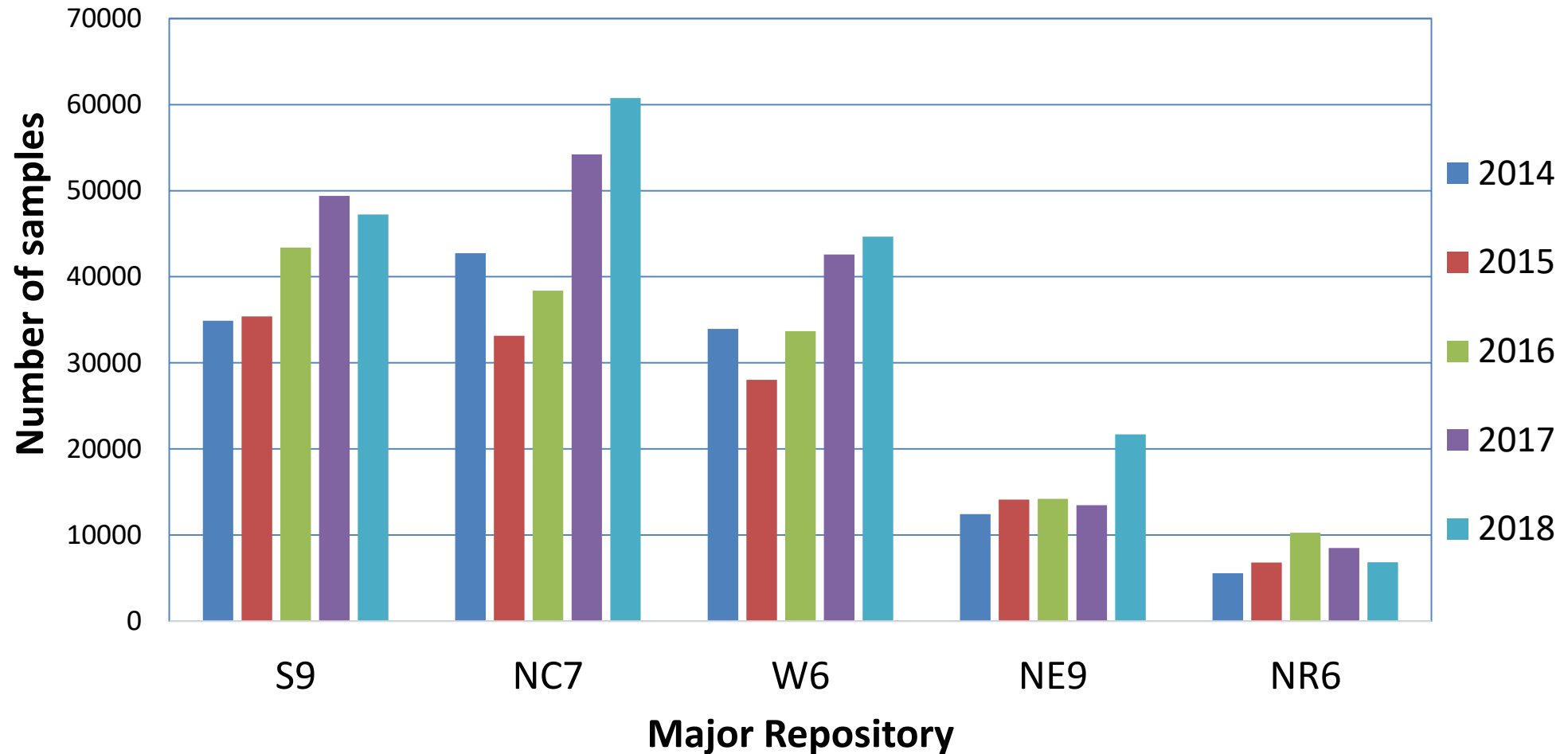
NRSP-6 and Regional Plant Introduction Stations Update

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

NRSP-6 and Regional Plant Introduction Stations 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



1,252,272 samples shipped by NPGS
between 2014-2018 (20 repositories)

Potato Genebank (NRSP-6)

-- *Service basics*--

Preservation, evaluation and distribution of ~5,000 botanical seed accessions of about 100 species and ~1,000 cultivated in vitro clones

Collected 33 new populations from Arizona in cooperation with CIP and received 9 new cultivars and breeding clones from cooperators

Increased 222 accessions as botanical seed populations and did 18,436 *in vitro* transfers to preserve and distribute clonal stocks



Performed virus tests of over 740 accessions, germination tests of 1,582 accessions, and ploidy determination of 35 accessions

Distributed 6,802 accessions... 6,018 in USA and 784 abroad

Potato Genebank (NRSP-6)

-- *Research and Development* --

Thousands of field plots, and screenhouse and greenhouse plantings supported cooperative research with a broad array of state, federal, industry and foreign collaborators on a full spectrum of topics.



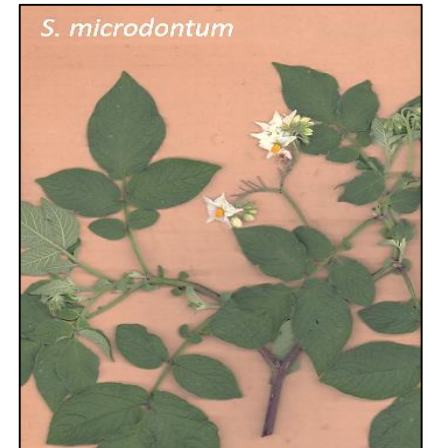
Potato Genebank (NRSP-6)

-- *Impact highlights*--

Joint release of new cultivar *Wiñay* with Peru



Discovered great tuber rot resistance in *S. microdontum*



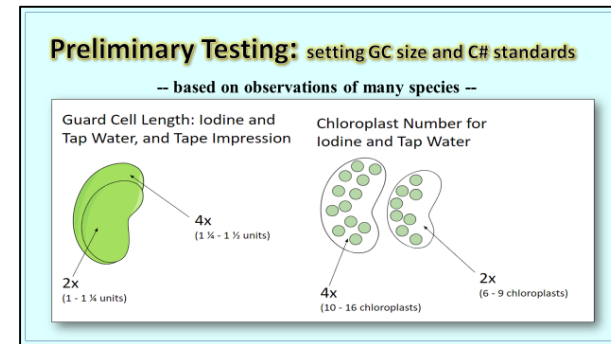
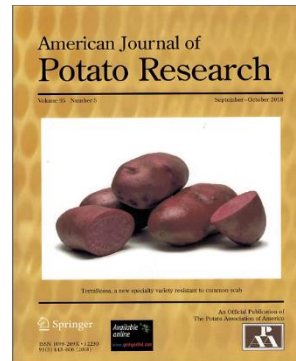
Discovered high root vigor in core collection



Validated new methods for rapid ploidy estimation

Created inbred form of "egg yolk" potatoes

All cultivar and breeding stocks published in 2018 had NRSP6 species in their pedigrees



Potato Genebank (NRSP-6)

-- Administration --

NPGCC met at Sturgeon Bay in 2018. Topics of concern expressed then have continued, with the NRSP Review Committee requesting a plan for budget reductions.

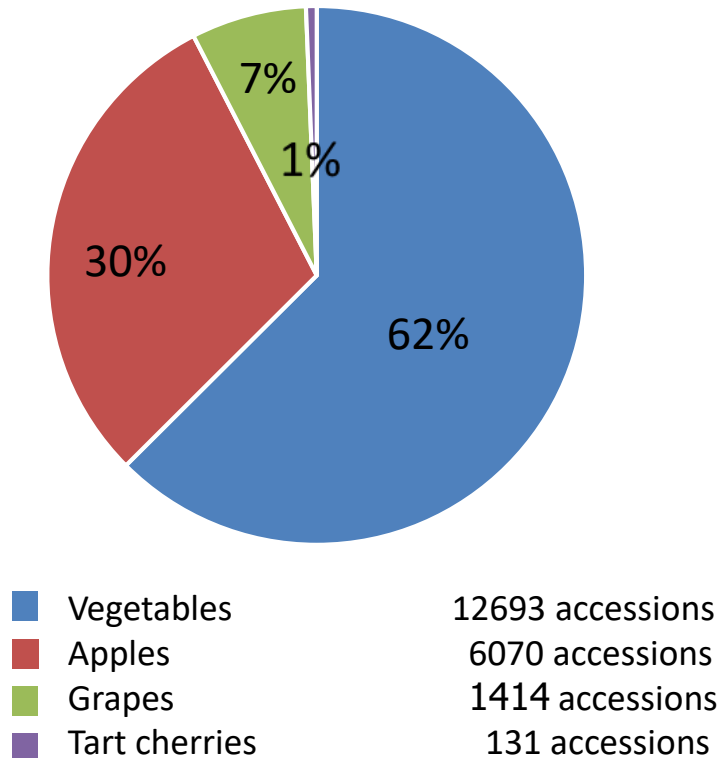
Over the past 25 years, NRSP6 has had greatly increased workload and impact despite a flat budget and reduced Wisconsin host state contributions. Hatch has increased.

In this context, NPGCC might assess sharing of the potato genebank support among the partners, and a fair contribution of NRSP6 funding for the next (FY21-25) budget cycle.



Northeast Regional PI Station (NE9)

Crops conserved

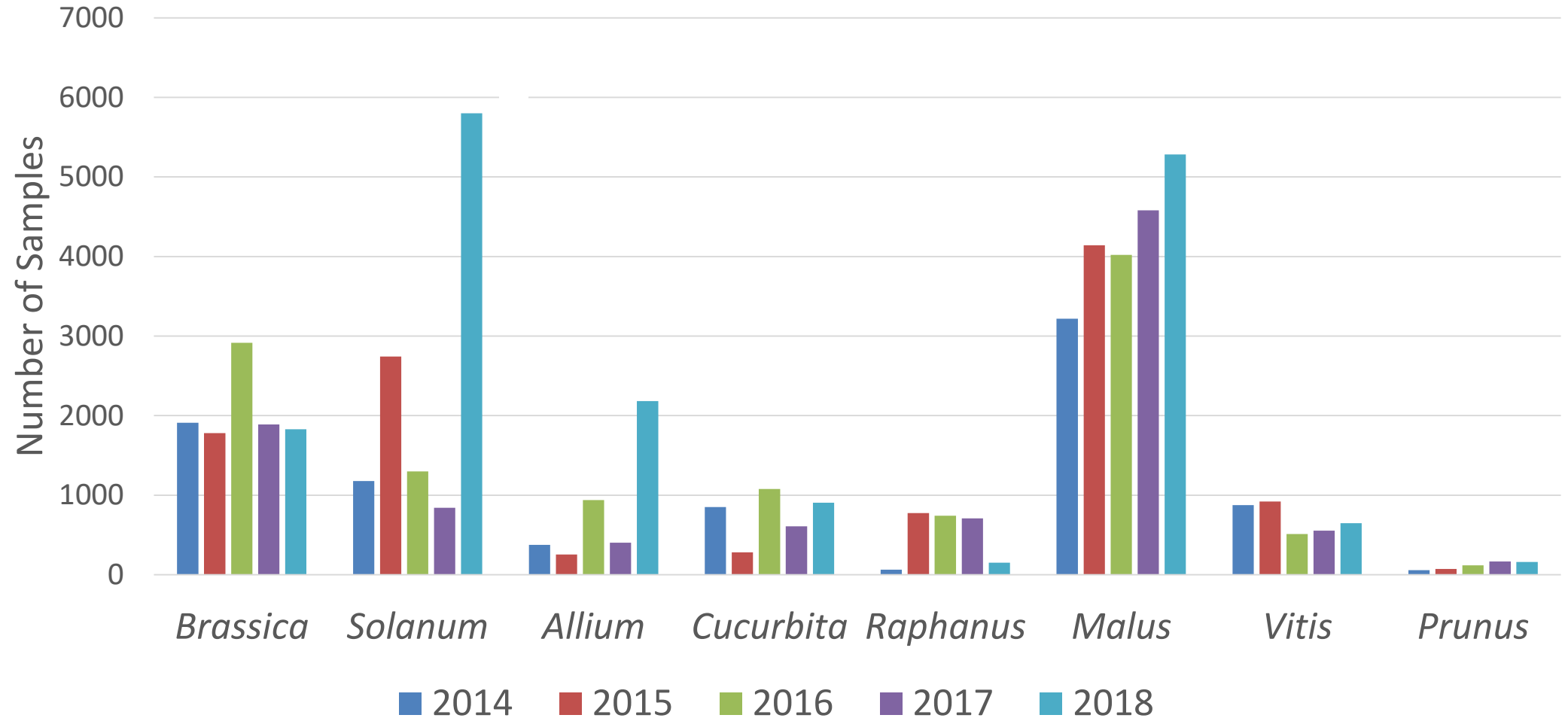


Two curatorial programs:

- ❖ Vegetable Crops (Joanne Labate & one vacancy) tomato, onion, radish, winter squash, cabbage, cauliflower, broccoli, other cole crops, celery, tomatillo, asparagus, buckwheat and other vegetables
- ❖ The major crops managed by this project represent approximately 40% of the combined dollar value of fresh and processing vegetables in the US.
- ❖ Clonal Crops (Thomas Chao & Ben Gutierrez) apples, grapes and tart cherries
- ❖ Apples, grapes, and tart cherries are among the most valuable fruit crops worldwide, with US production valued at
 - \$ 6.3 billion for grapes
 - \$ 3.5 billion for apples
 - \$ 89.4 million for tart cherry

Distribution of Select NE9 Geneva

21,702 vegetable and clonal germplasm samples in 2018 and 75,890 samples from 2014 – 2018, involving 45 countries.



Northeast Regional PI Station (NE9)

Germplasm regeneration, collection, and outreach highlights:

- Successful regeneration of 705 accessions from 2014 – 2018 (average 141 seed lots produced/yr), 231 regenerations planned in 2018 for seed production of vegetable germplasm to distribute and replenish stocks.
- PGRU continues to support organic farming by providing germplasm and demonstrations for small-scale seed production as part of the Northern Organic Vegetable Improvement Collaborative (NOVIC3).
- Foreign exploration to Viet Nam for tropical apple species, *Malus doumeri*.



tomato seed cleaning demo

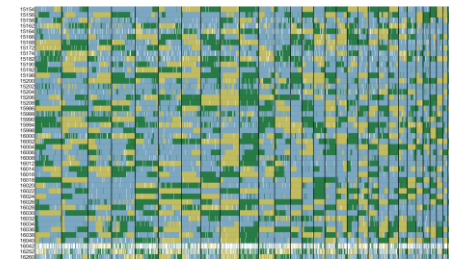
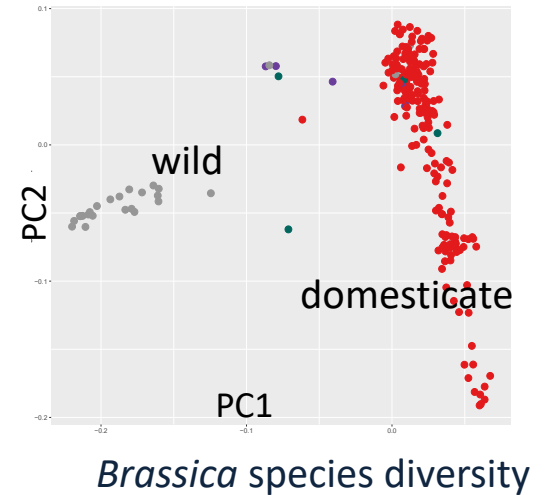


Malus doumeri fruit

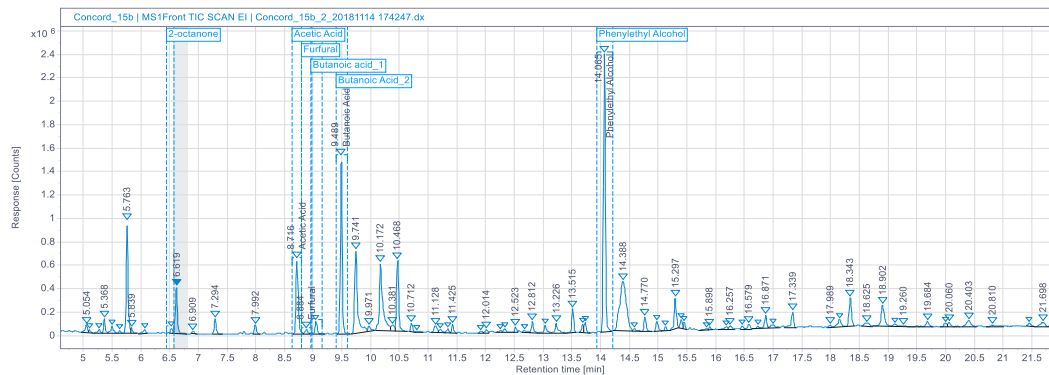
Northeast Regional PI Station (NE9)

Germplasm research highlights:

- The closest wild relatives to *Brassica oleracea* were elucidated using RNA sequencing. Results suggested a Mediterranean origin of domestication.
- Molecular markers in onion were developed, mapped, and used to estimate genetic diversity in PGRU accessions.
- Acquisition of GCMS for chemical profiling of crops



onion markers in linkage groups



Aroma analysis in grapes



budding in apple

Northeast Regional PI Station (NE9)

Germplasm research highlights:

- A backlog of more than 70,000 observations and 787 images collected during vegetable crop regenerations were uploaded into GRIN-Global during 2018.
- The tart cherry collection was characterized for chemical and molecular diversity. PGRU identified rich anthocyanin diversity within the collection.

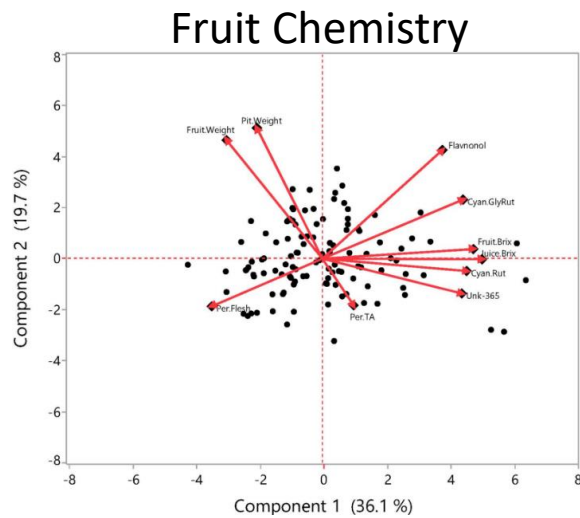
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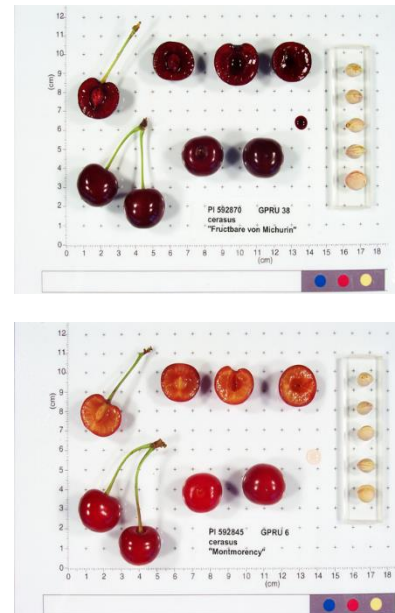
Results Match: All Conditions Any Condition Results have 0

BRIX (459) (Any) <input type="text"/> 3.37 <input type="text"/> 3.4 <input type="text"/> 3.43 <input type="text"/> 3.7 <input type="text"/>	TA (345) (Any) <input type="text"/> 0.15 <input type="text"/> 0.18 %wt/vol <input type="text"/> 0.19 %wt/vol <input type="text"/> 0.2 <input type="text"/>
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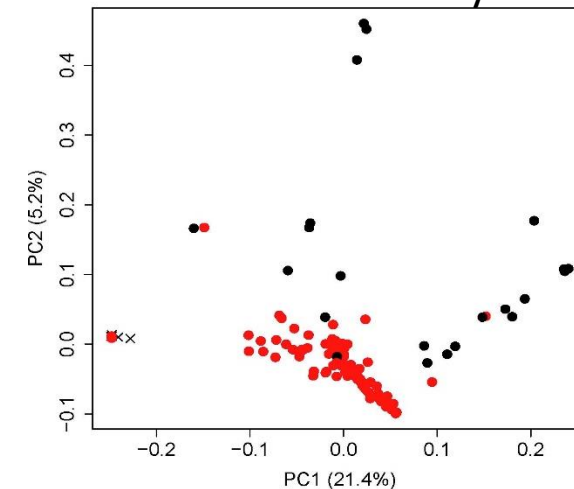
tomato data in GRIN



Anthocyanin diversity



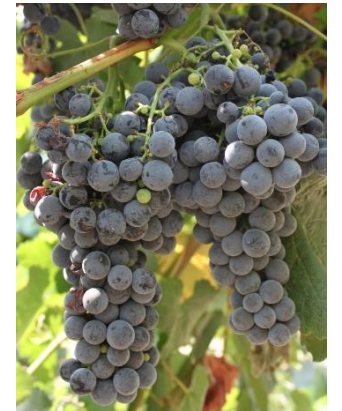
Genetic Diversity



Northeast Regional PI Station (NE9)

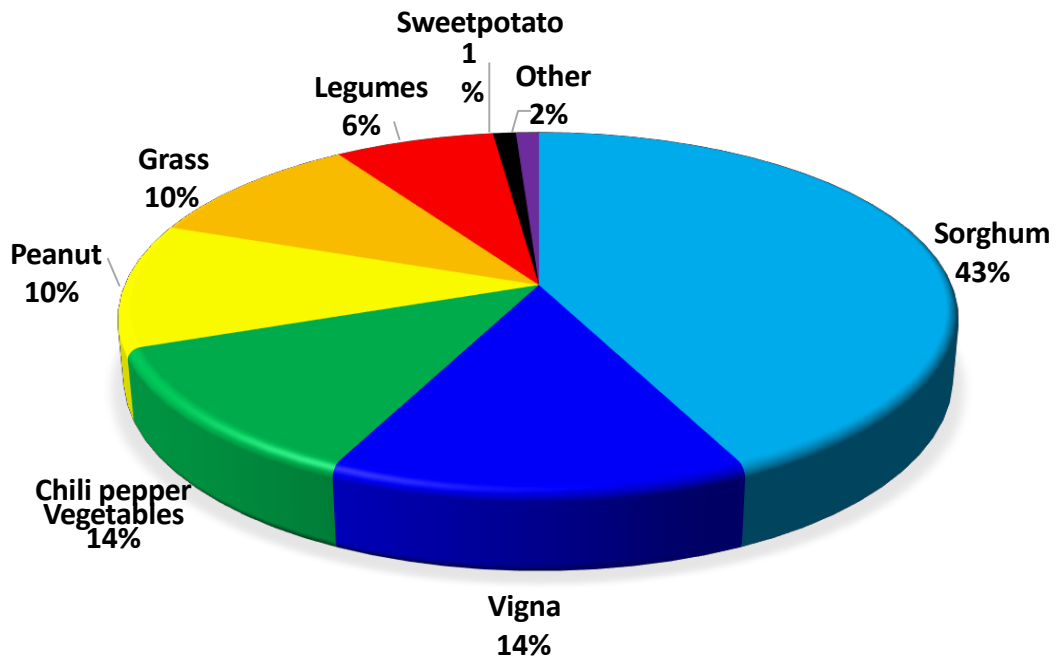
Administration highlights:

- Joanne Labate – the new curator for vegetable crops
- A new operation model for field support: one team, one farm
- Several vacancies and slow hiring
- Flat NE09 project budget and future impacts



Southern Regional (S-009)

Crops managed

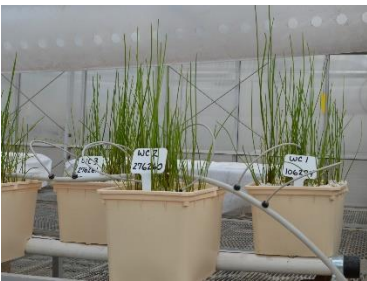


Curators and Scientists

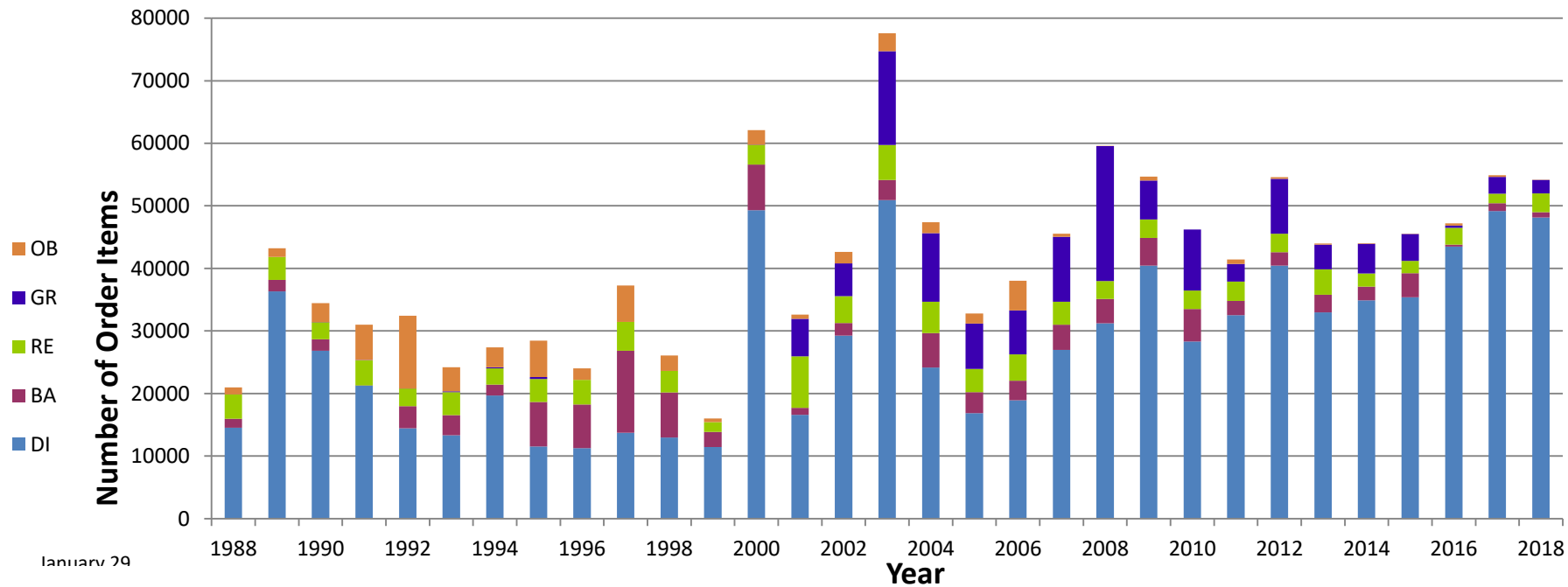
- Sorghum & S-009 Millets (Melanie Harrison)
- Peanut & Vigna (Shyam Tallury)
- Pepper, Melons, Vegetables (Bob Jarret)
- Legumes, Warm-season Grasses, Clover (Brad Morris)
- Sweet Potatoes (Ming Li Wang)

Southern Regional (S-009) Stats

- This project has grown from 811 accessions of 41 genera in 1949 to **100,193** accessions representing 282 genera and 1604 species in 2019.
- In 2018, 46675 accessions were distributed worldwide to stakeholders.
- Over 88% of S-009 accessions are available for distribution and over 97% are safely backed up.
- Approximately 88% of the accessions have inventories at -18°C to extend seed viability in storage.



Southern Regional (S-009) Stats



OB = Observation; GR = Germination; RE = Regeneration; BA = Back Up; DI = Distribution

Southern Regional (S-009)

Characterization Efforts

- Fruit quality traits have been evaluated in a subset of *Capsicum* germplasm and genetic characterization of *Capsicum* continues.
- Virus testing is underway for several vegetable crops including *Citrullus* (Bacterial Fruit Blotch) and *Cucurbita moschata* (Squash Mosaic Virus).
- Select sorghum lines have been screened for abscisic acid sensitivity.
- Protein content and flavonoid content have been measured in select accessions of vigna and protein content in select accessions of sesame.
- Functional DNA markers have been developed in peanut (FAD2A and FAD2B) to assist in identifying high oleic acid peanut germplasm.



Southern Regional (S-009)

Crop Germplasm Committee News

Included in our Project Plan are goals to increase CGC participation and update Crop Vulnerability Statements.

Crop Vulnerability Statements (CVS)

- Sweetpotato CVS and Sorghum CVS have been reviewed and updated.
- Update of the Forage and Turf Grass CVS is in progress.

Crop Germplasm Committee (CGC) Participation

- Based on input from its members, the Vigna CGC has been moved from the Regional Horticulture meeting to the ASA-CSSA-SSA Annual Meeting in hopes of increasing attendance.



Southern Regional (S-009)

Personnel Changes:

- New Hires\Appointments:
 - Tiffany Fields was promoted to Seed Storage Manager. Previously, Ms. Fields served as a seed storage technician for over 22 years.
 - John Sherouse joined our team in March 2019. Mr. Sherouse will provide facility maintenance for all federal buildings at the Griffin location including HVAC, refrigeration, plumbing, electrical, carpentry, and other projects.

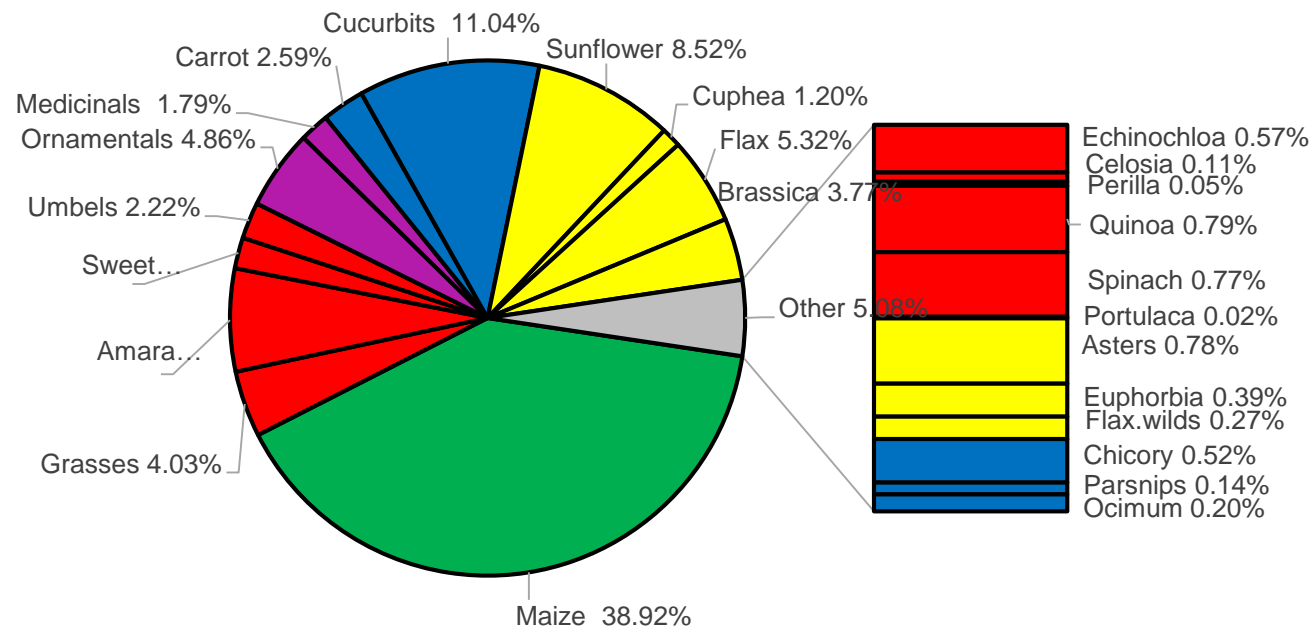
- Vacancies to be Advertised Soon:
 - Seed Storage Technician (Biol Sci Tech; GS-4/5/6)



North Central Regional PI Station (NC-007)

Curation of more than 55,000 Accessions

- Strategic collection development; three collection trips executed in 2018 for horticultural species, two in progress in 2019

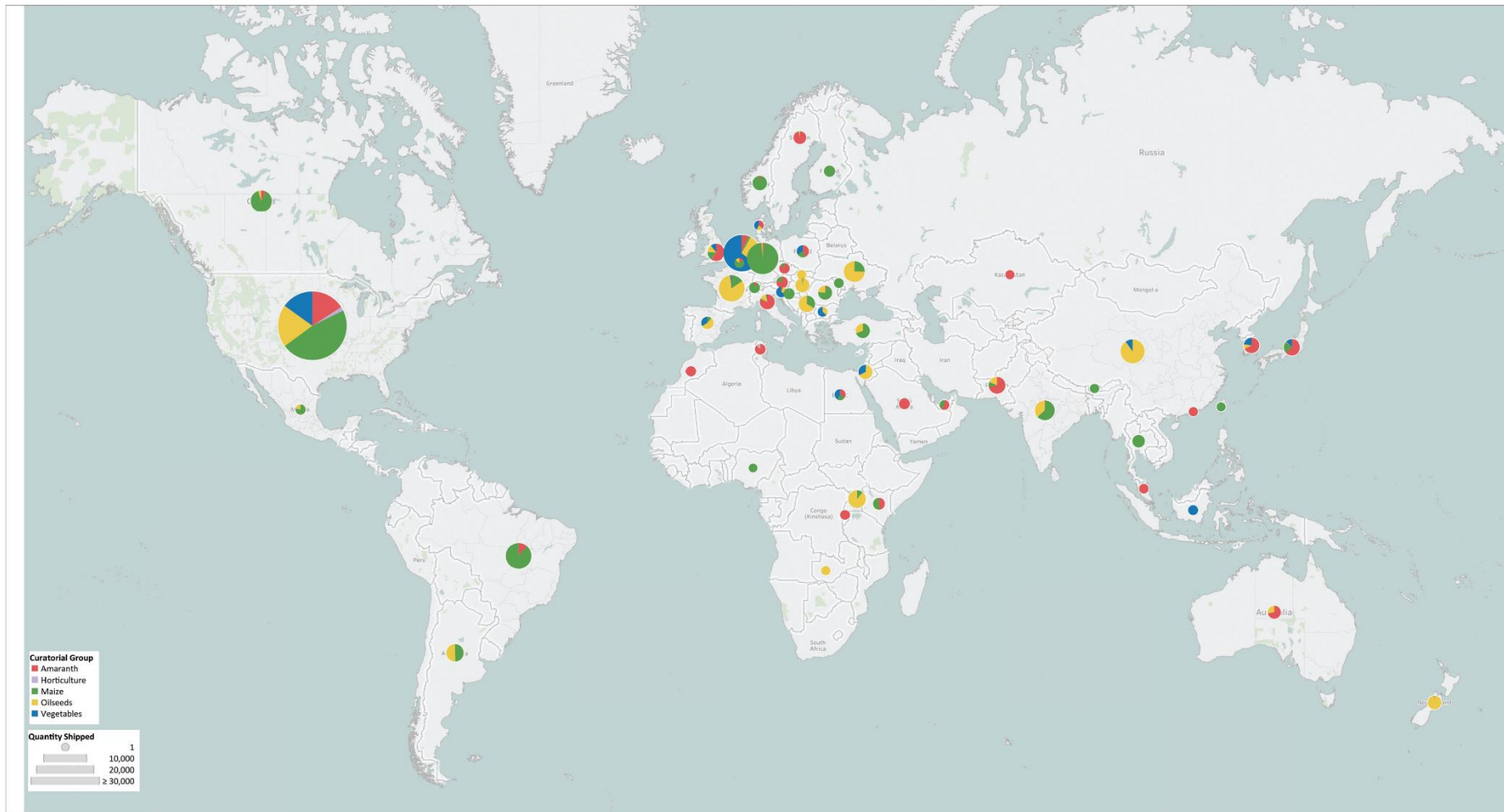


Collecting record blue ash tree seeds, *Fraxinus quadrangulata*

Distribution

- *Maintain and provide* high quality, well-documented germplasm for research and educational objectives for primarily heterogeneous, heterozygous, outcrossing crops;
- *Distributed* more than 61,500 packets in 2018; ~1/2 in U.S., 1/2 to internationals; of U.S. recipients, ~1/2 to Landgrant Institutions;
- *Characterization and evaluation to increase collection utility – user community examples*
 - *Daucus* SCRI project – uses applied genomics to develop enhanced *D. carota* breeding lines based on the NPGS cultivated *D. carota* collection for nematode resistance, heat tolerance, flavor and diversity analysis, cavity spot evaluation, bolting; root nutritional pigments; root appearance; nine distributions of ~700 accessions to SCRI participants
 - SCRI participants with Crop Trust projects: developing breeding pools by intermating superior performing plants for traits mentioned above, genotyping phenotyped plants for both projects
 - *Daucus* germplasm used for heat and drought resistance evaluation in Bangladesh and Pakistan (Phil Simon, PI)
 - About 22% of the 11,000 *Helianthus* distributions were used for pre-breeding line evaluations for drought, salt, or flooding tolerance, and disease resistance

2018 Worldwide NCRPIS Germplasm Distributions

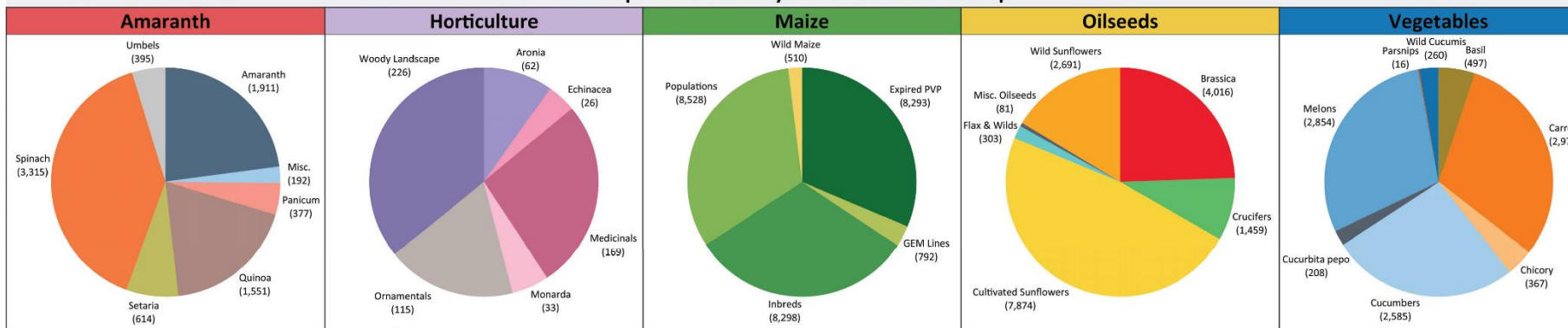


Curatorial Group	United States	International	Grand Total
Amaranth	5,069	3,286	8,355
Horticulture	602	29	631
Maize	15,157	11,264	26,421
Oilseeds	6,441	9,983	16,424
Vegetables	4,827	4,932	9,759
Grand Total	32,096	29,494	61,590

2018 NCRPIS Germplasm Distribution Detail

Country	Quantity
Argentina	666
Australia	188
Austria	89
Belgium	21
Bhutan	6
Brazil	2,350
Bulgaria	22
Canada	1,365
China	2,011
Croatia	67
Czech Republic	40
Denmark	19
Egypt	60
Finland	74
France	2,615
Germany	4,394
Hong Kong	9
Hungary	275
India	1,076
Indonesia	24
Israel	303
Italy	370
Japan	548
Kazakhstan	6
Kenya	104
Korea, South	429
Malaysia	11
Mexico	32
Moldova	20
Morocco	29
Netherlands	6,512
New Zealand	237
Nigeria	3
Norway	311
Pakistan	592
Poland	126
Romania	268
Rwanda	15
Saudi Arabia	55
Serbia	548
Slovakia	8
Slovenia	44
Spain	137
Sweden	168
Switzerland	57
Taiwan	5
Thailand	146
Tunisia	48
Turkey	341
Uganda	716
Ukraine	1,242
United Arab Emirates	20
United Kingdom	666
United States	32,096
Zambia	6

Crop Distributions by NCRPIS Curatorial Group



Use of Optical Sorting Equipment for Seed Characterization/Optimization

VMEK Metrix (Vision-based) is in use for sorting maize, millet, soybean, and sorghum, resulting in improved seed lots for purity, germination, removal of cracked/off-color/broken kernels/fungal infected seeds, and optimizing maize seedlots for machine planting

QSorter instrument is in experimentation / development phase for use as a research tool – combines NIR and Vision



Before



After

Phytosanitary Issues of Concern

Prevent the distribution of specific taxa to some countries
Seed-borne diseases are of specific interest, and our new Plant Pathologist, Dr. Anna Testen, is excited to collaborate with our curatorial personnel to develop research devoted to these issues

- Prevent seed transmission of *Acidovorax citrulli* in *Cucumis melo*, which causes bacterial fruit blotch

- Investigate methods to render *A. citrulli* non-infective in seeds

- Investigate treatments of Brassica seed for blackleg disease

- Continue to develop additional PCR and ELISA methods

2018 Information System Development in Ames

New version of the GRIN-Global Curator Tool, v 1.9.8.30 released to genebank personnel

Updated Viability Wizard for processing information from germination testing released

New Attachment Wizard for attaching documents (PDFs, images, spreadsheets, text docs) to accession/inventory records released

Enhanced Order Wizard for more efficient processing of germplasm orders released

Enhanced Search Tool

Developed Excel tools for better order management

Use of Tablo graphical tools for presentation

Western Regional PI Station (W-006)

1) Managing the genetic resources of diverse crops/crop groups

Five curatorial programs:

1. Agronomy and grasses (**Vice-Bradley**)



forage and turf grasses



Safflower

2. Beans (**Theodore Kisha**)



various *phaseolus* species

3. Cool season food legumes (**Clare Coyne**)



pea, lentil, chickpea, faba bean, lupine, fenugreek, grasspea, etc.

4. Temperate forage legumes (**Brian Irish**)
located in Prosser, WA



Alfalfa,



Clover and



lotus,

and Native plants

5. Horticultural and miscellaneous crops (**Barbara Hellier**)



lettuce,



sugar beets,



selected ornamentals,
and



medicinal
plant species

2. Conducting mission-related research:

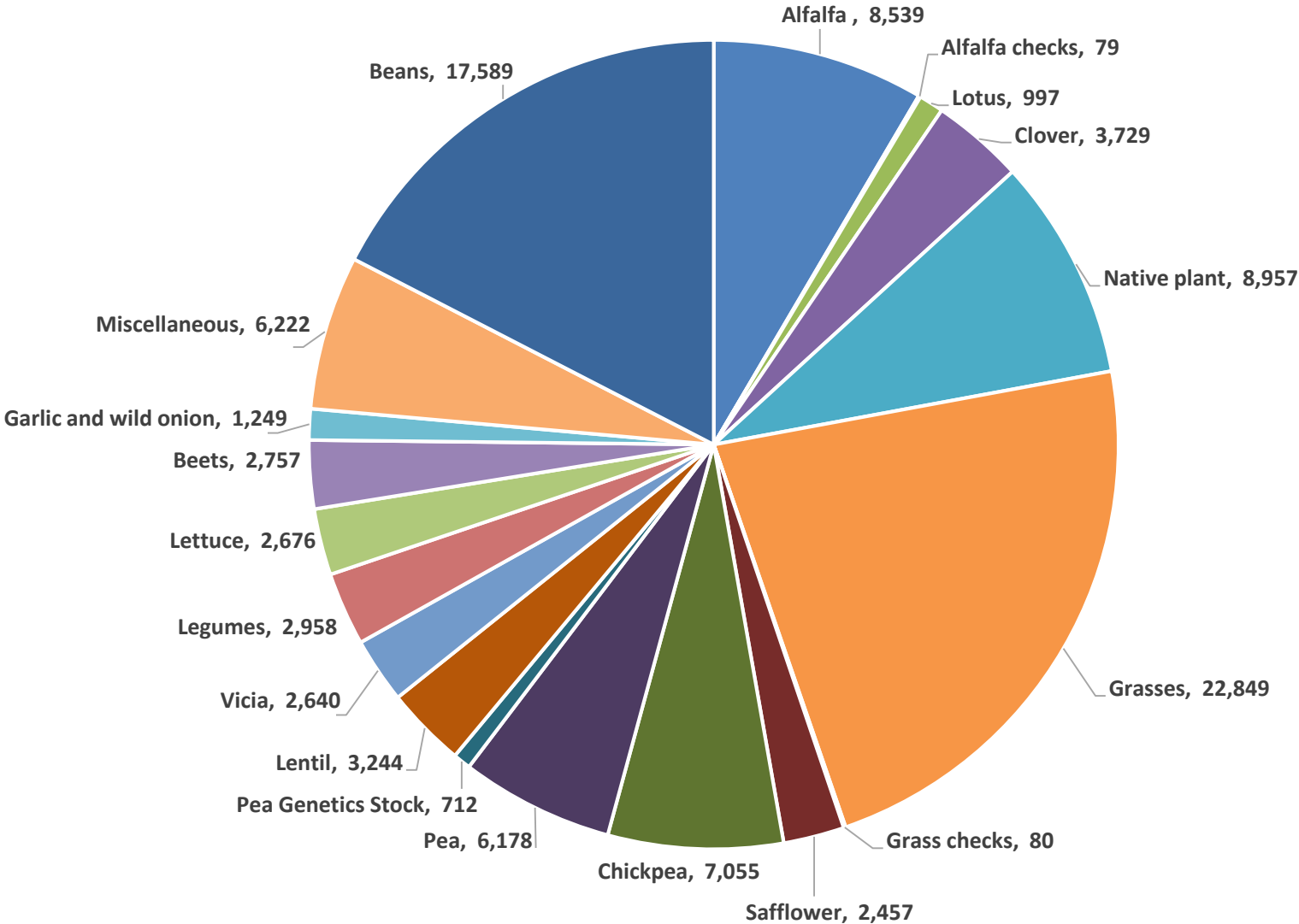
Three research programs:

1. Plant pathology (**Vice-Dugan**)
2. Genetics (**Jinguo Hu**)
3. Genetics (**Long-Xi Yu**), located in Prosser, WA

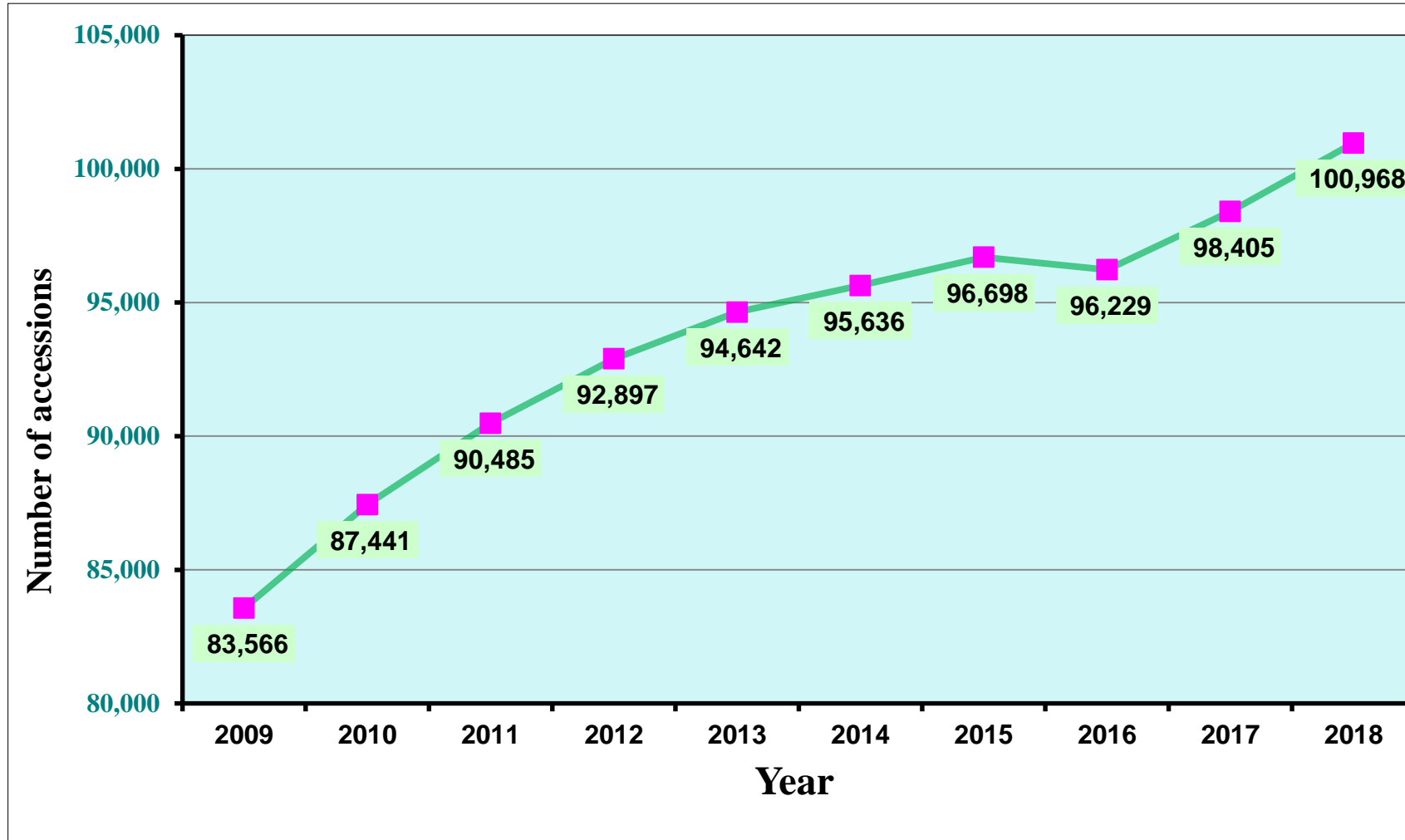


Accessions in each major crop groups maintained at W-6

100,968 accessions from 169 countries as of April 29, 2019

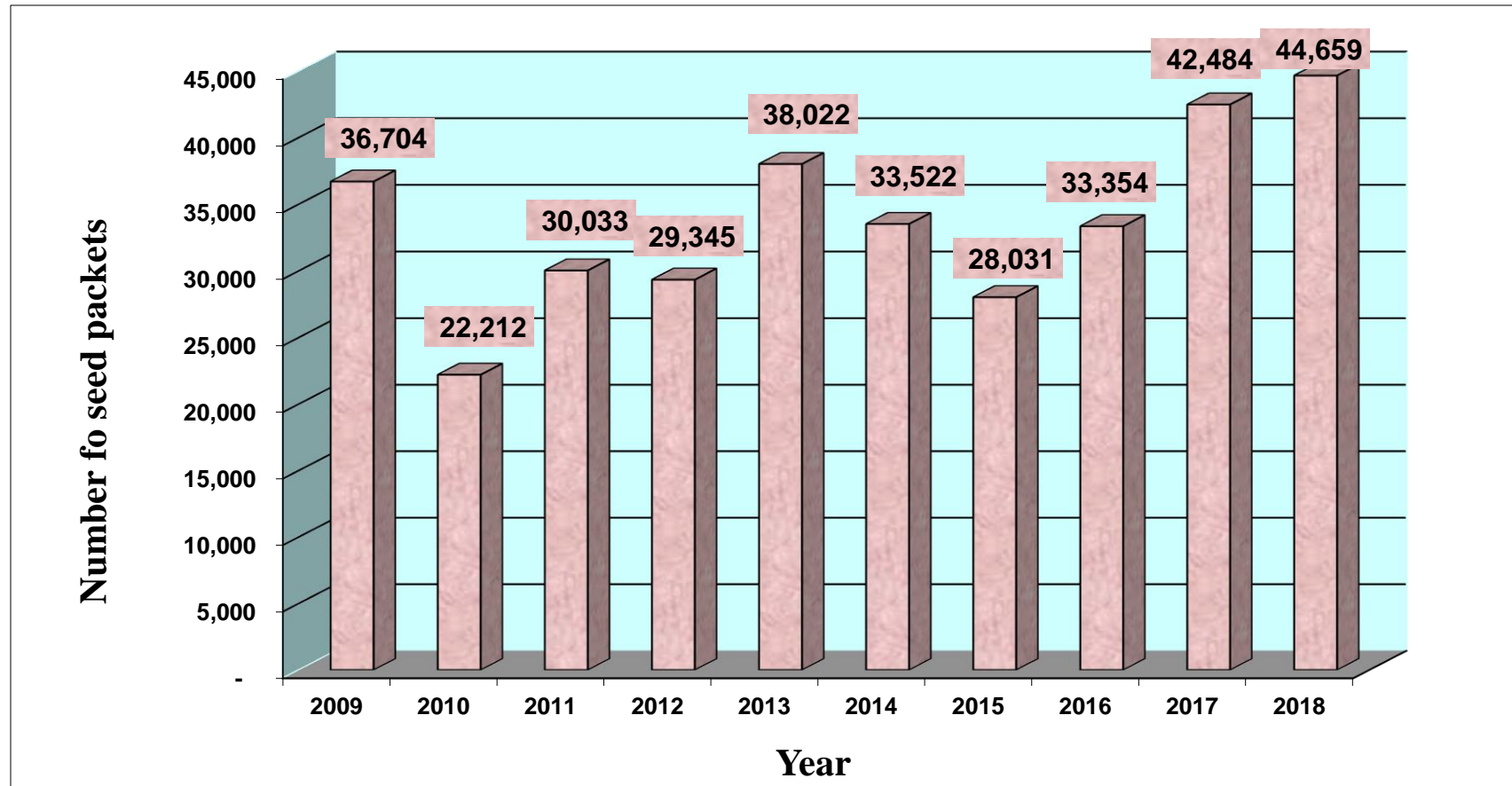


Number of accessions managed by W-6 station continues to grow



As of December 31, 2018, these accessions were belonging to 4,887 species (5,593 taxa) in 1,107 genera.

Serving the global plant research community by providing needed germplasm samples



Number of seed packets distributed by WRPIS each year since 2009. Last year's distribution was a record high.

Hand transplanting lupine plants at the Pullman Farm



May 2, 2019

Regeneration of common bean germplasm in the new bubble house at Central Ferry Farm

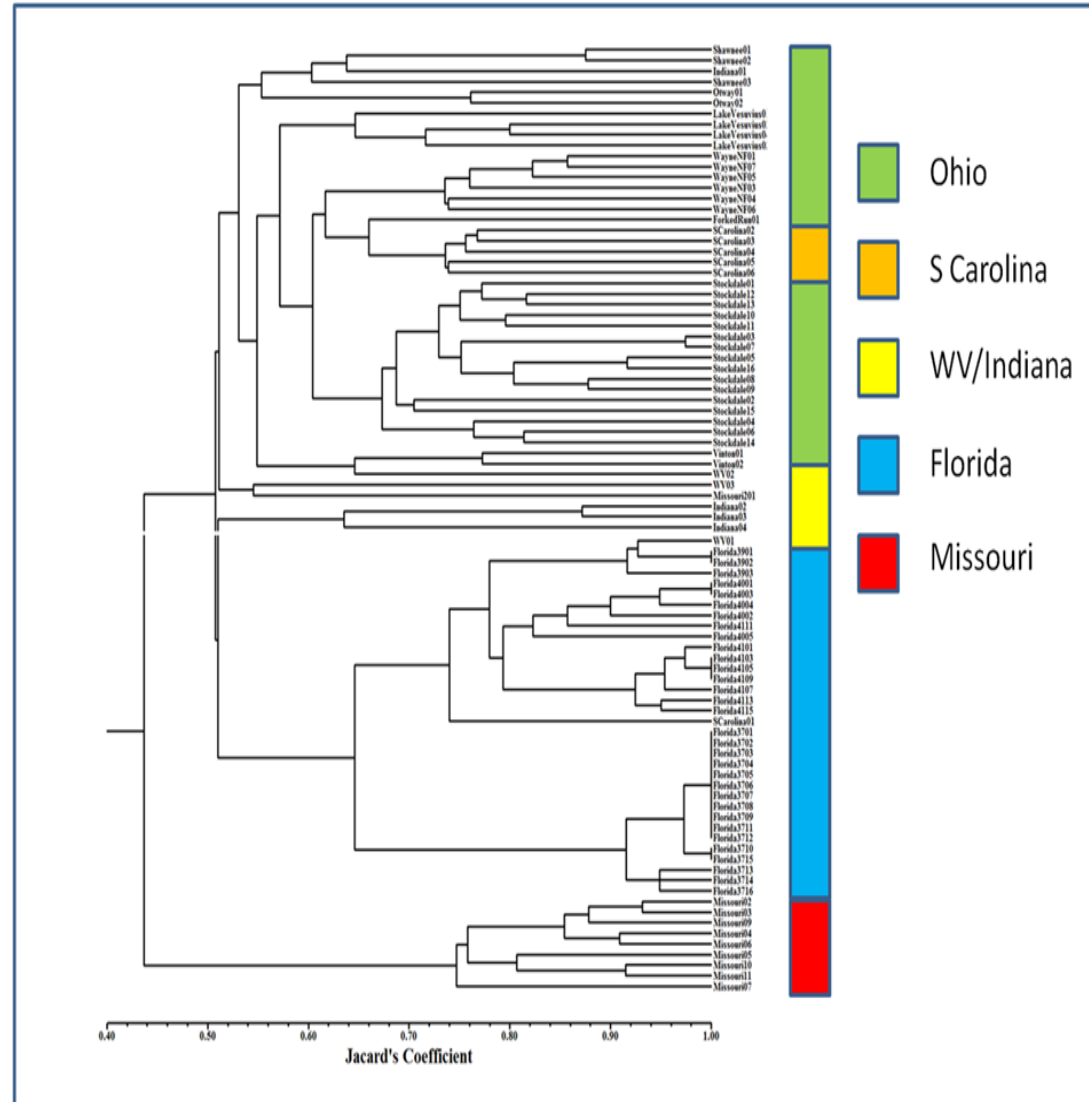


The alfalfa research project at Prosser, WA



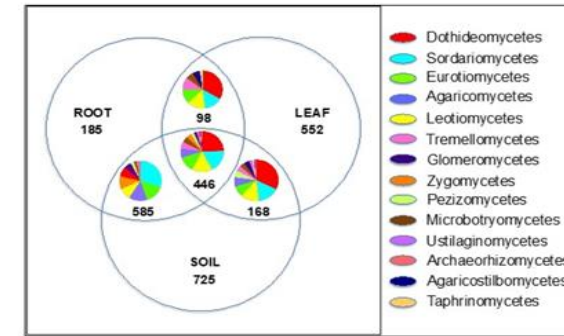
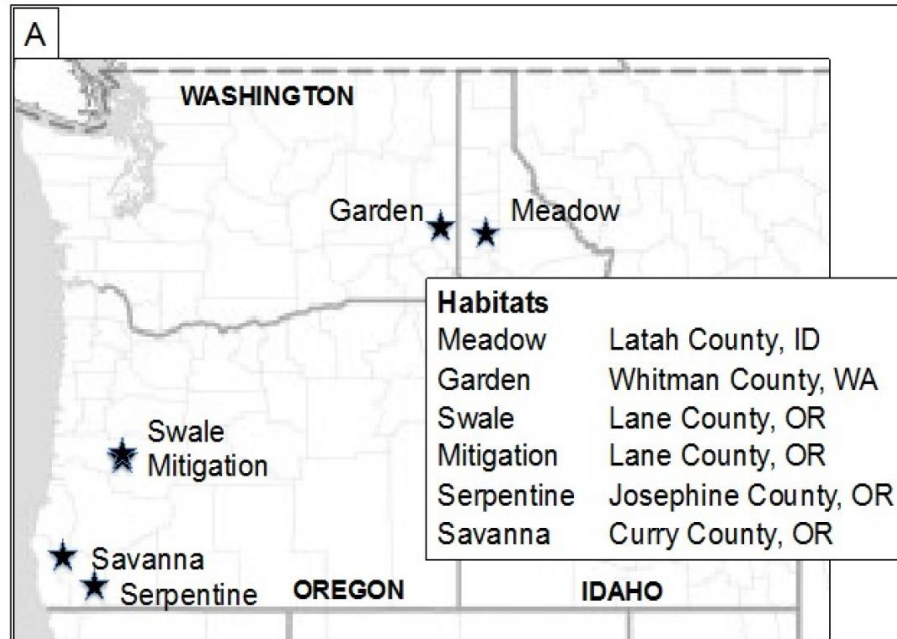
Research Geneticist Dr. Long-Xi Yu started to use high throughput phenotyping tools in collaborating with WSU for his replicated field study of alfalfa drought tolerance and forage quality (NP 215).

New wild bean relative accessions recently added



Seeds from more than 70 populations of *Phaseolus polystachios*, a wild relative of common bean, have been collected from their natural habitats throughout Eastern United States and added to our collection. Our preliminary diversity analysis with a small number of DNA markers shows that the genetic variation varies with geographic locations.

Fungal communities associated with camas (*Camassia*) at six wetland habitats in western North America

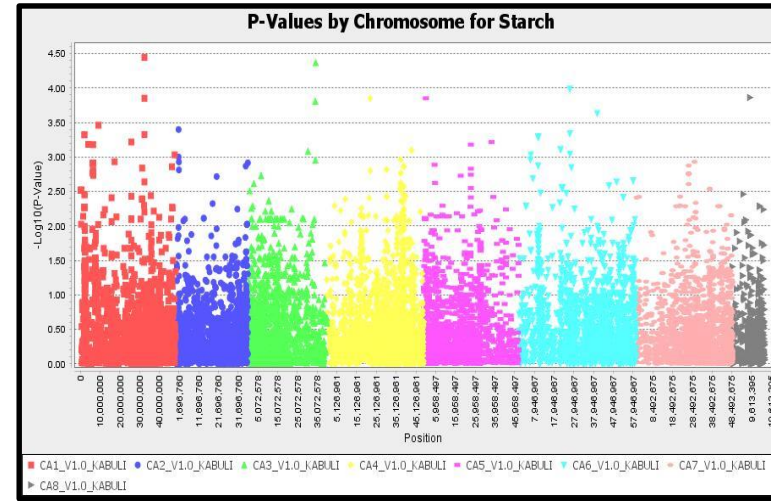
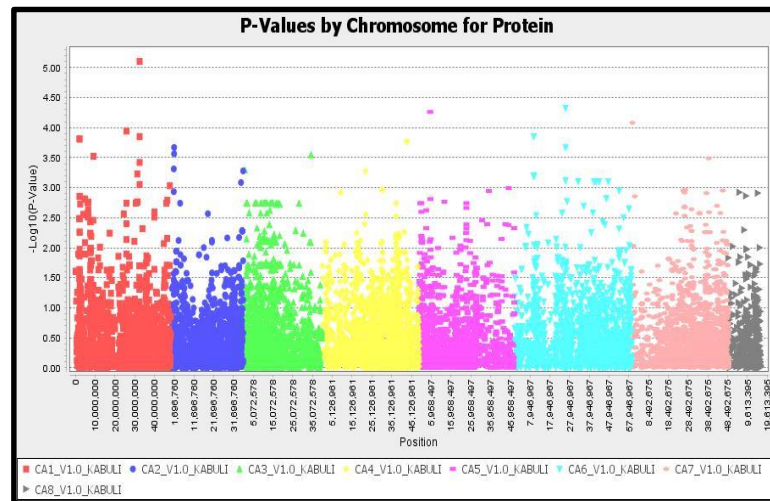
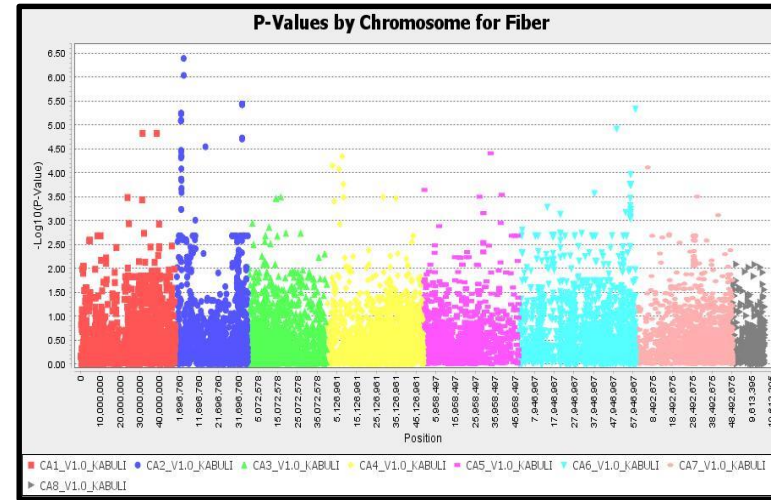
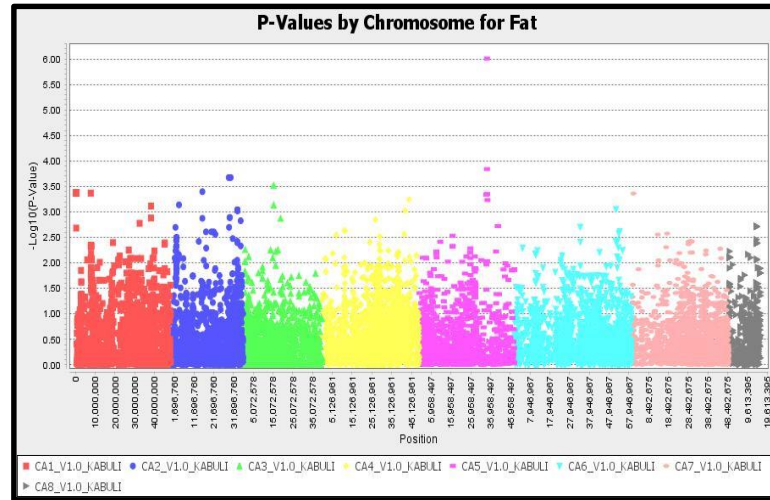


Left: A, habitat site map; B, two camas bulbs with and without a tunic and a flowering camas plant;

Above: Venn diagram of the number of fungal OTUs detected in the camas roots, rhizospheres, and tunics of plants sampled. At least 200 fungal families were found in the samples.

This is from the Ph. D. dissertation of Mrs. Gretchen Freed, a graduate student of the WSU Plant Pathology Department and co-advised by Research Plant Pathologist Frank Dugan.

Identified SNP markers associated with four major nutrients in kabuli chickpea seeds





Personnel changes:

Federal:

New Hire:

Mrs. **Lisa Taylor** started in April, 2019 as the Seed Storage and Database Manager of the W6 Station. Lisa was reassigned to this position and Mr. **Dave Stout**, retired in March 2018, has been helping us part time and passing his knowledge and expertise to Lisa and others at the station.

Mrs. **Carla Olson** started in June, 2019 as the Program Support Assistant of the Unit. Carla was reassigned to this position after she indicated her willingness to apply for the Vice-Dann position. We thank our HR that initiated, and our Area Office that approved this action. We welcome Carla back to our unit and she is the best PSA!

Retired:

Mr. **Frank Dugan**, Research Plant Pathologist, retired on September 29, 2018 after 31 years of working with USDA (19 years with the Agricultural Research Service and 12 years with the Forest Service) plus five years of working as a Collection Scientist, American Type Culture Collection, Rockville, MD and Manassas, VA.

Mr. **James Dann**, Program Support Assistant, relocated to ARS Florence, South Carolina upon being offered an Administrative Office position there in August 2018.

State:

Mr. **Charles Golob**, Pullman farm manager, expressed his desire to return to WSU turf research program. Washington State University started the search for a new farm manager early May. Charles will help the station with 50% of his working hours till the farm manager position is filled.

Mrs. **Julia Christian** was hired in August 2018 as one of the Pullman farm technicians. Julia is a hard worker and has a strong background in farming. She is a great addition to WRPIS.

Hosted a field trip of the 5th grade class from La Crosse, WA



May 18, 2018

Hosted the high school students in the Upward Bound Program



A potluck lunch celebrating Frank Dugan's successful 31 years of federal service



September 26, 2018

A potluck lunch celebrating Dave Stout's successful 40+ years at the W-6 station



Plant Germplasm Operations Committee

- PGOC meeting: June 19-20, 2018 at the USDA George Washington Carver Center; Curator Workshop: June 21.
- National Development: NPGS updates, International treaty on plant genetic resources for food and agriculture, Plant exchange office report, update from genebank Mexico, Status of NPGS seed testing.
- GRIN-Global: Implementation, Advisory Committee, Data management etc.
- Emerging Issues and Continuing Discussion Topics:
 - ✓ Training the next generation of plant genetic resource managers
 - ✓ Quarantine issues for a repository
 - ✓ Managing genetic resource collections with reduced resources
 - ✓ New REE P&P for ARS procedures and best management practices for genetically-engineered traits in plant germplasm and breeding lines