



# **PGOC and Regional Plant Introduction Stations Update**

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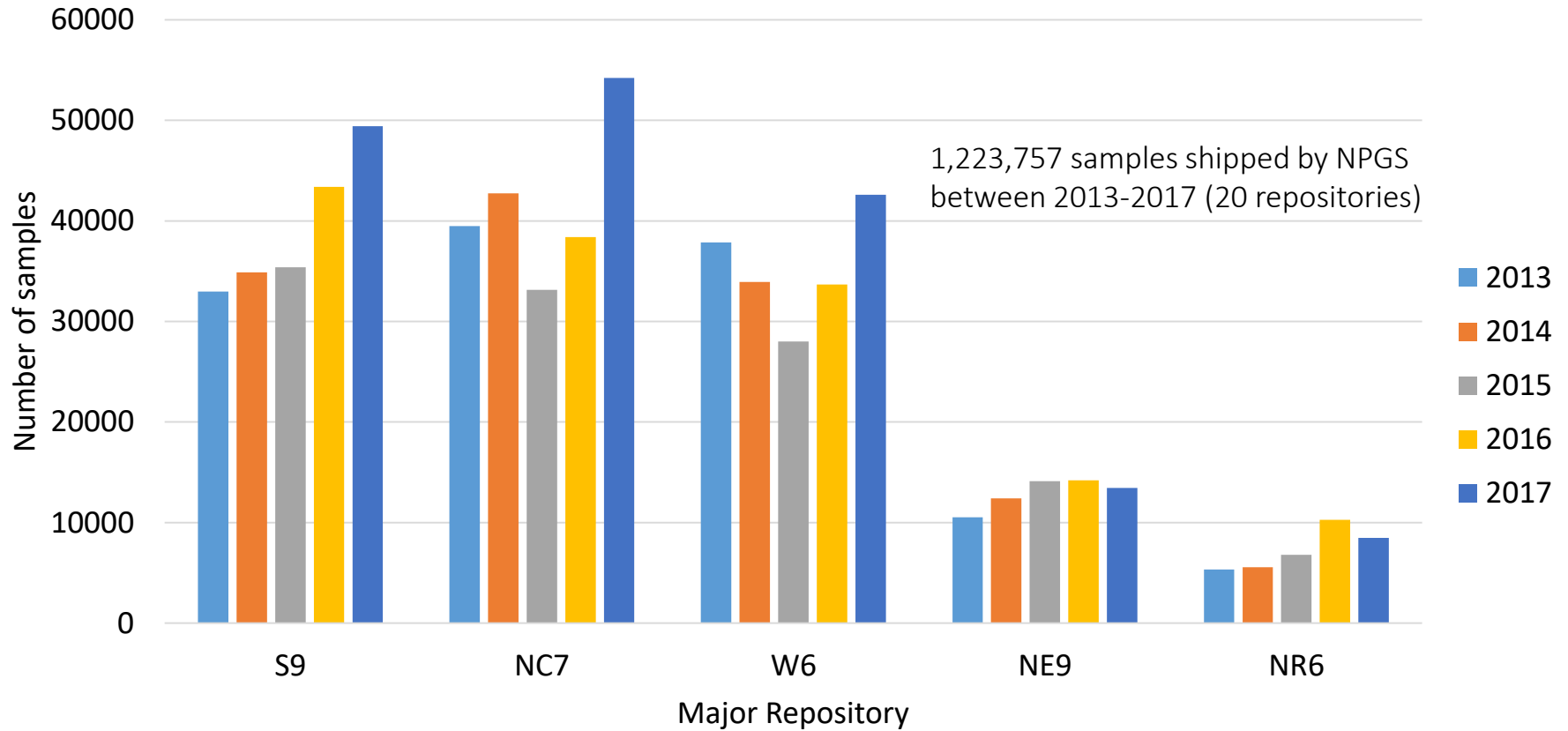
# Plant Germplasm Operations Committee

- ✓ A 2hr. short PGOC meeting was convened via teleconference call on Oct. 17, 2017
- ✓ John Preece (PGCO Chair) and Stephanie Greene (Vice PGOC Chair) hosted the teleconference call.
- ✓ The 2018 PGOC meeting will take place at the USDA/ARS National Arboretum in Washington, DC on June 19-21, 2018.
- ✓ Peter Bretting: Current Status and Challenges Facing the National Genebanks.
- ✓ Gary Kinard: Update in GRIN-Global and the National Germplasm Resources Laboratory
- ✓ John Preece: Strategies to Help Solve Resource Limitation Challenges for the National Plant Germplasm System

# US Regional Plant Introduction Station Functions

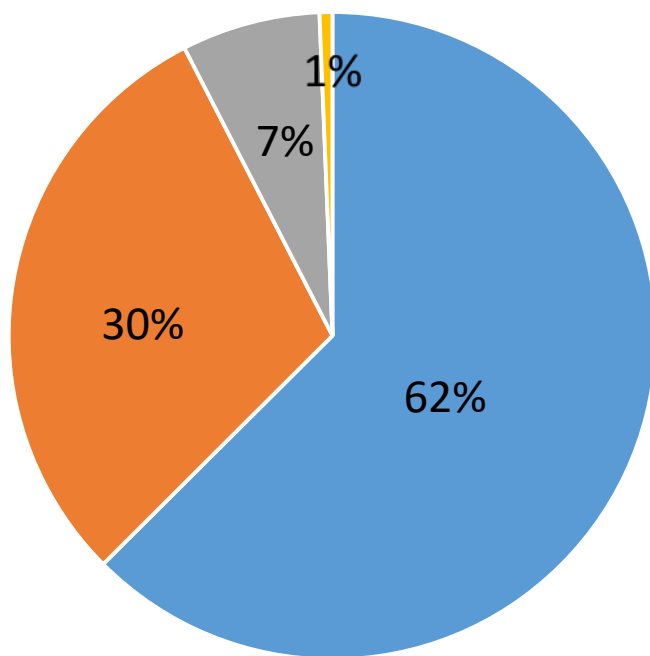
- Acquire, conserve and distribute plant genetic diversity and associated information
- Encourage use of germplasm (User-focused)
- Conduct research to improve genetic resource management programs
- Evaluate and characterize germplasm to facilitate targeted research objectives
- Conduct prebreeding activities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

# Germplasm Distributions for 5 Major Repositories



# Northeast Regional PI Station (NE9)

## Crops conserved



■ Vegetables	12690 accessions
■ Apples	6069 accessions
■ Grapes	1405 accessions
■ Tart cherries	130 accessions

## 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
- ❖ Clonal Crops (Thomas Chao & Ben Gutierrez) apples, grapes and tart cherries

# Northeast Regional PI Station (NE9)

## Highlights:

- Distribution of 13,446 germplasm samples in 2017 and 64,706 samples from 2013 – 2017.
- Successful regeneration of 796 accessions from 2013 – 2016 (average 200/yr) 225 regenerations performed in 2017 for seed production of vegetable germplasm to distribute and replenish stocks.
- Clonal collection added 55 scion and 45 seed accessions to the *Malus* collection.

## *Wild Malus explorations*



# Northeast Regional PI Station (NE9)

## Highlights:

- Vegetable collection continues to provide germplasm, training, workshops and demonstrations for small-scale seed production to the Northern Organic Vegetable Improvement Collaborative.
- Clonal collection hosted 90 groups/classes with 1,708+ students, growers, researchers, and general stakeholders at the collection from 2012-2017.



Organic Farming Conference outreach



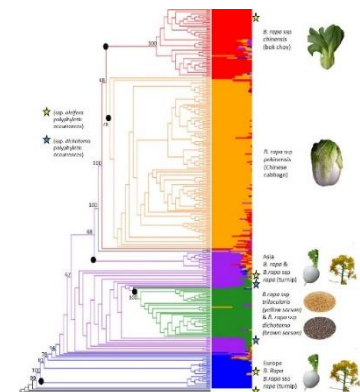
College classes, growers, and CBS clonal visits



# Northeast Regional PI Station (NE9)

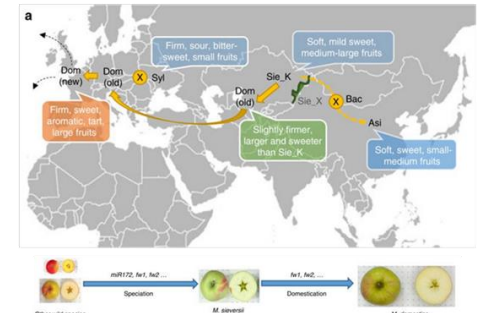
## Highlights:

- Characterization data are collected during routine regenerations from vegetable crops; a backlog of more than 6,000 observations for seed crops were uploaded into GRIN-Global since 2017.
- Genetic relationships among of the diverse range of *Brassica rapa* edible types were elucidated using DNA sequencing.
- Tomato cation profile results will provide insight for development of new tomato varieties with favorable nutrient profiles in terms of human health and fruit quality.
- Genome analyses of *Malus* species revealed that the domestication of apple fruit size was a two-stage events and only the *M. sieversii* in Central Asia directly contributed to the domestication of modern day apples.
- A novel QTL controlling grape berry size was identified using a GWAS analysis



*Brassica rapa* subspecies diversity

Fig. 2a. Apple evolutionary map along the west and east bounds of the Silk Route with center of origin at Kazakhstan in central Asia





# Northeast Regional PI Station (NE9)

## Impacts of NE9 Collections:

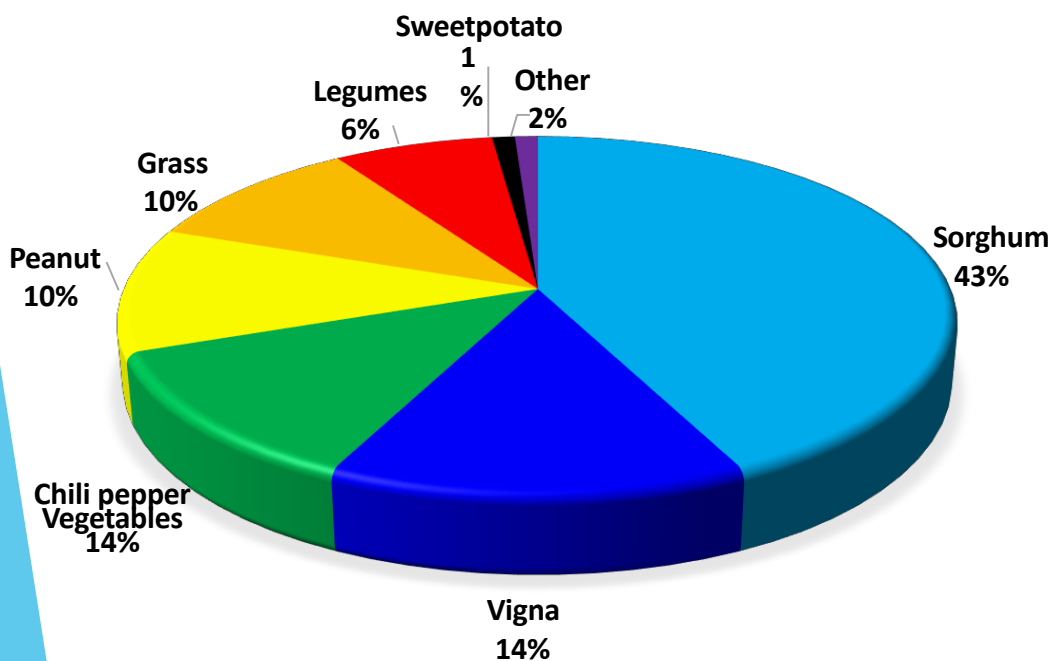
- The major crops managed by this project represent approximately 36% of the combined dollar value of fresh and processing vegetables in the USA in 2017.
- Genes from wild tomatoes have been used to increase ease of harvesting, stress and drought tolerance, and for resistance to pests and diseases. Since the 1960s, the value of fresh and processed tomato to the USA economy increased from \$347 million to its current value of \$1.7 billion.
- *Malus* collection is the largest and most diverse collection in the world.
- The collection contributes significantly to the breeding of grape and apple scions and rootstocks with superior disease, pest, and environmental stresses resistance.
- The collection contributes to the development of emerging cider apple industry



Novel blue mold resistance from wild *M. sieversii*

# 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)

**Please note that several changes in curation responsibilities have taken place this year as reflected in the above list.**

# Southern Regional (S-009) Stats

- This project has grown from 811 accessions of 41 genera in 1949 to 99,414 accessions representing 263 genera and 1601 species in 2018.
- In 2017, over 49,000 accessions were distributed worldwide to stakeholders.
- Over 84% of S-009 accessions are available for distribution and over 95% are safely backed up at Ft. Collins, CO
- Approximately 88% of the accessions have inventories at  $-18^{\circ}\text{C}$  to extend seed viability in storage.

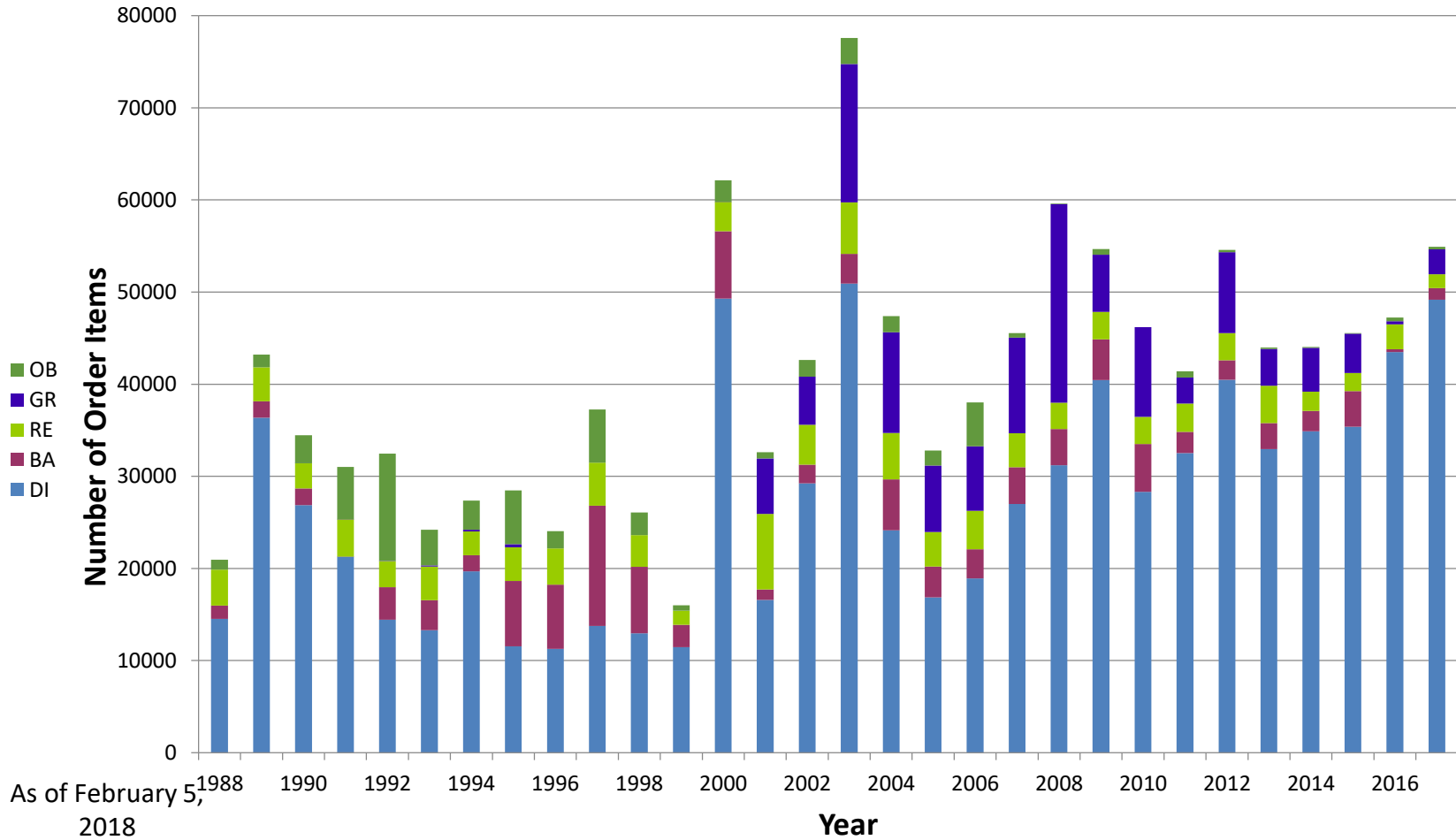


# Southern Regional (S-009)

## Personnel Changes:

- There were three retirements this past year: Lee Ann Chalkley (Seed Storage Manager), David Pinnow (Plant Pathologist), and Merrelyn Spinks (IT Specialist\GRIN-Global Database Manager).
  
- New Hires\Appointments:
  - Nick Stigura was hired in Feb 2018 as the IT Specialist\GRIN-Global Database Manager
  - Melanie Harrison was appointed permanent Research Leader effective October 1, 2017.
  - Mylee Mobley was hired in April 2018 as the new peanut technician (S-009 employee)
  
- Vacancies Approved and to be Advertised Soon:
  - Seed Storage Manager (Biol Sci Tech; GS-7/8/9)
  - Maintenance Mechanic (WG-9/10)

# Southern Regional (S-009) Distributions



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

# Southern Regional (S-009)



## Characterization Efforts

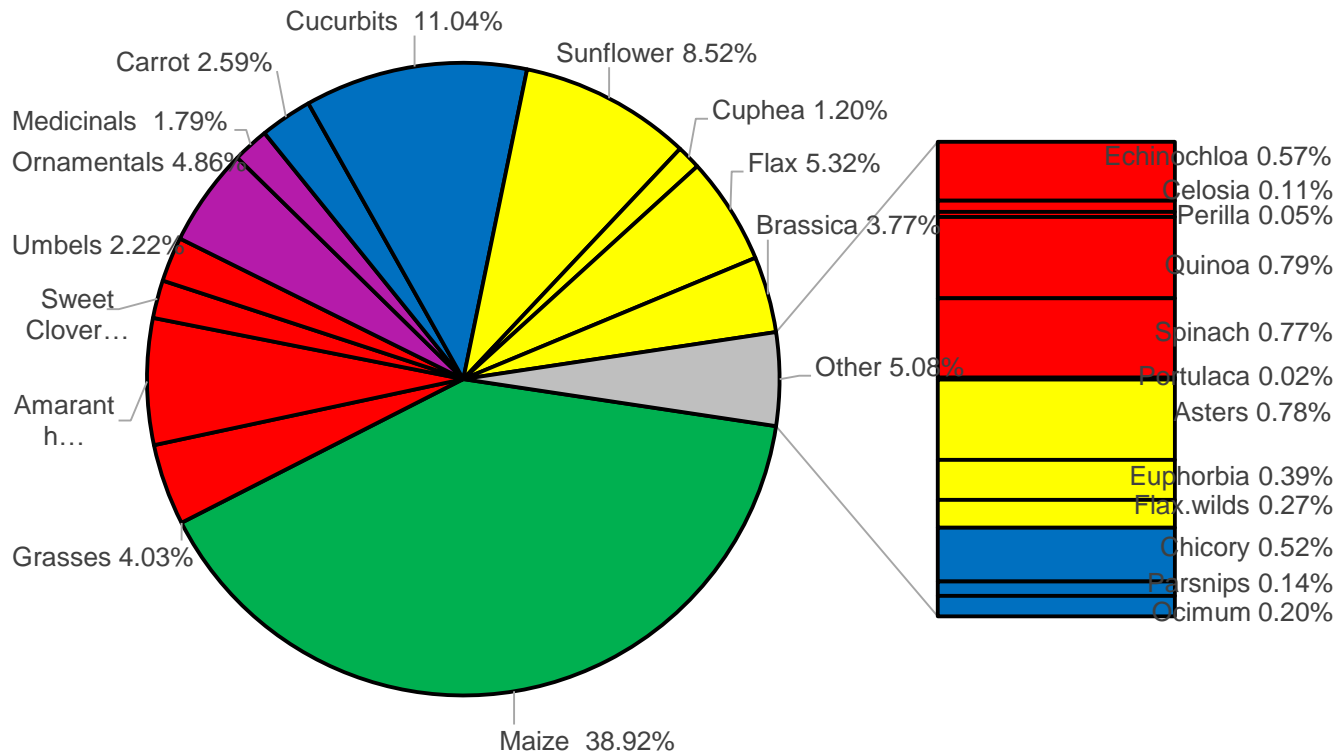
- Seed from 325 watermelon accessions were evaluated for root growth characteristics in collaboration with ARS scientists at Charleston, South Carolina.
- A total of 769 and 1,846 cultivated peanut accessions were evaluated for oil content and fatty acid composition, respectively. Three cultivated peanut accessions were identified that contain a high concentration of oleic acid (averaging 80%), and molecular markers for the high oleic acid trait have been developed for peanut breeders to use.
- Collaborating with ARS scientists in Puerto Rico and Lubbock, Texas, 320 sweet sorghum accessions have been evaluated for early-spring cold tolerance. More than 255 sorghum mutants generated using ethyl methanesulfonate-mutagenesis were sequenced and resulted in the identification of six abscisic acid insensitive mutants for potential environmental stress tolerance.
- Genetic diversity for seed traits and protein content in 111 cowpea core accessions was determined using principal component and cluster analysis.
- A first year crude protein evaluation of seed from 26 functional vegetable accessions including *Vigna* species, sesame, guar, and jute showed crude protein content ranging from 14-26%.
- Seeds from eight field grown sesame accessions were evaluated for the nutritional compounds, sesamin and sesmolin with content ranging from 0.788-6.68 mg/g.



# North Central Regional PI Station (NC-007)

## Curation and Distribution of 54,412 Accessions

- Strategic collection development; 194 new accession in 2016; 2576 in past 6 years, including 360 pre-breeding sunflower lines containing introgressions from 11 different crop wild relative annual *Helianthus* taxa (below)



Collecting record blue ash tree seeds, *Fraxinus quadrangulata*

# North Central Regional PI Station (NC-007)

## Curation and Distribution, cont.

- Maintain and provide high quality, well-documented germplasm for research and educational objectives for primarily heterogeneous, heterozygous, outcrossing crops; more than 55,000 packets distributed in 2017
- Characterization and evaluation to increase collection utility



Completion of 4-yr  
collaboration on  
taxonomic revision of  
*Daucus* and allied  
Apiaceae



# North Central Regional PI Station (NC-007)

## Germplasm Maintenance

Provide six insect pollinator species on demand to support regenerations and software to help manage pollinator requests



Outreach event demonstrating pollinator technologies utilized



# North Central Regional PI Station (NC-007)

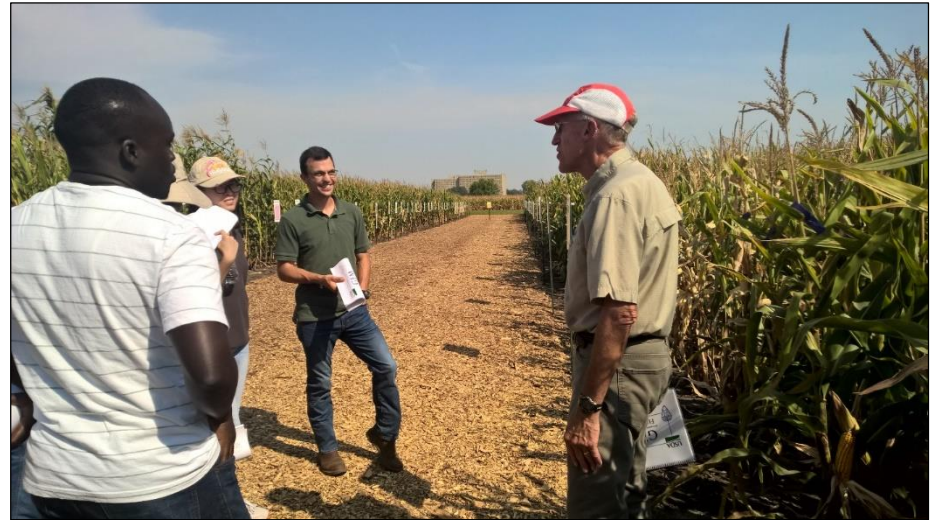
## 2017 Information System Development in Ames

- New version of the GRIN-Global Curator Tool, v 1.9.8.14 released to genebank personnel
- New 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
- Enhancements to the Order Wizard for more efficient processing of germplasm orders released
- Developed Excel tools for better order management
- New Pollinator Tool compatible with GRIN-Global in use for creating, tracking, and closing requests for insect pollinators in regeneration cages



# North Central Regional PI Station (NC-007)

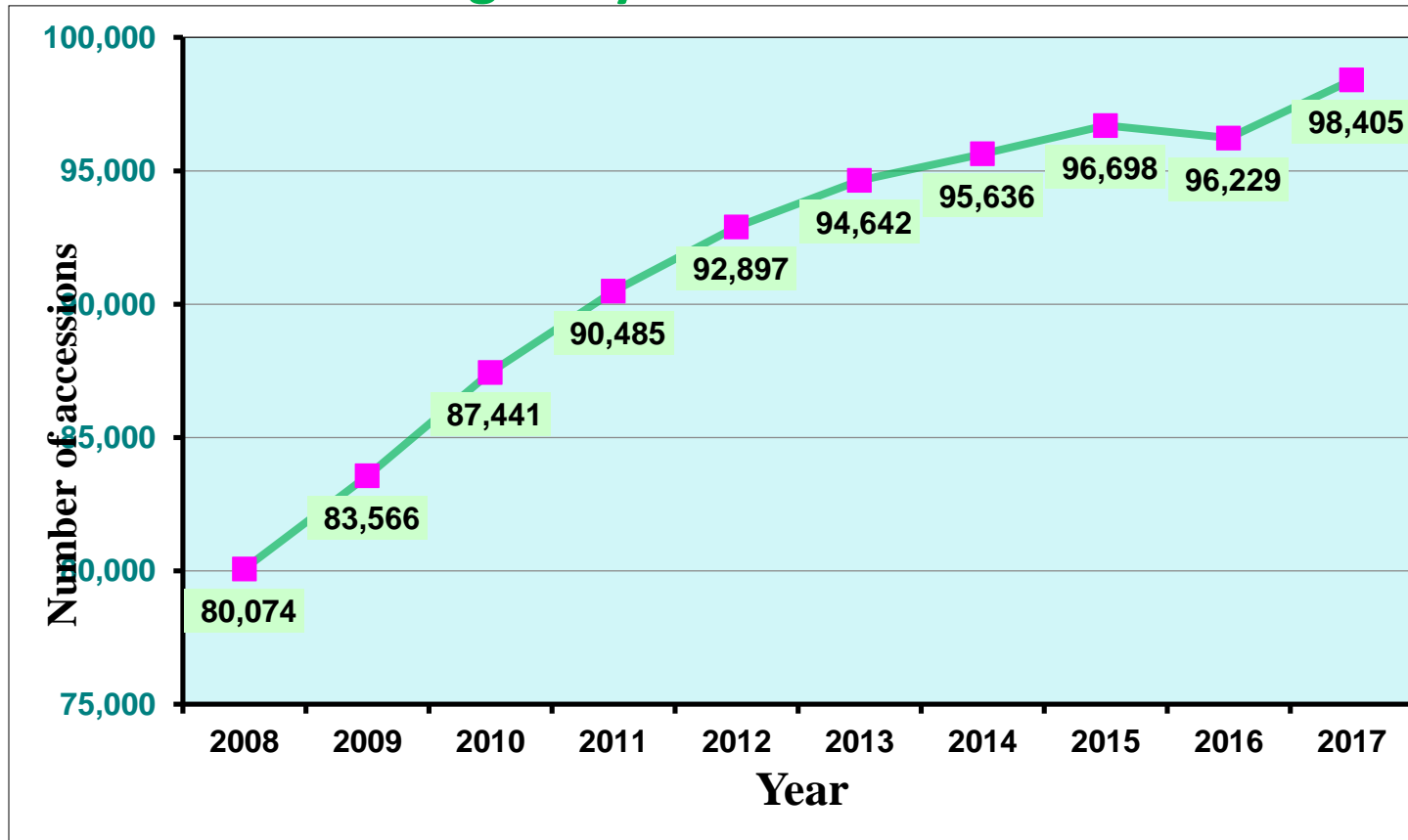
## Field Days and Outreach



Sunflower prebreeding lines (top left);  
Amaranthus (bottom left);  
GEM Project Field Day (above)

# Western Regional PI Station (W-006)

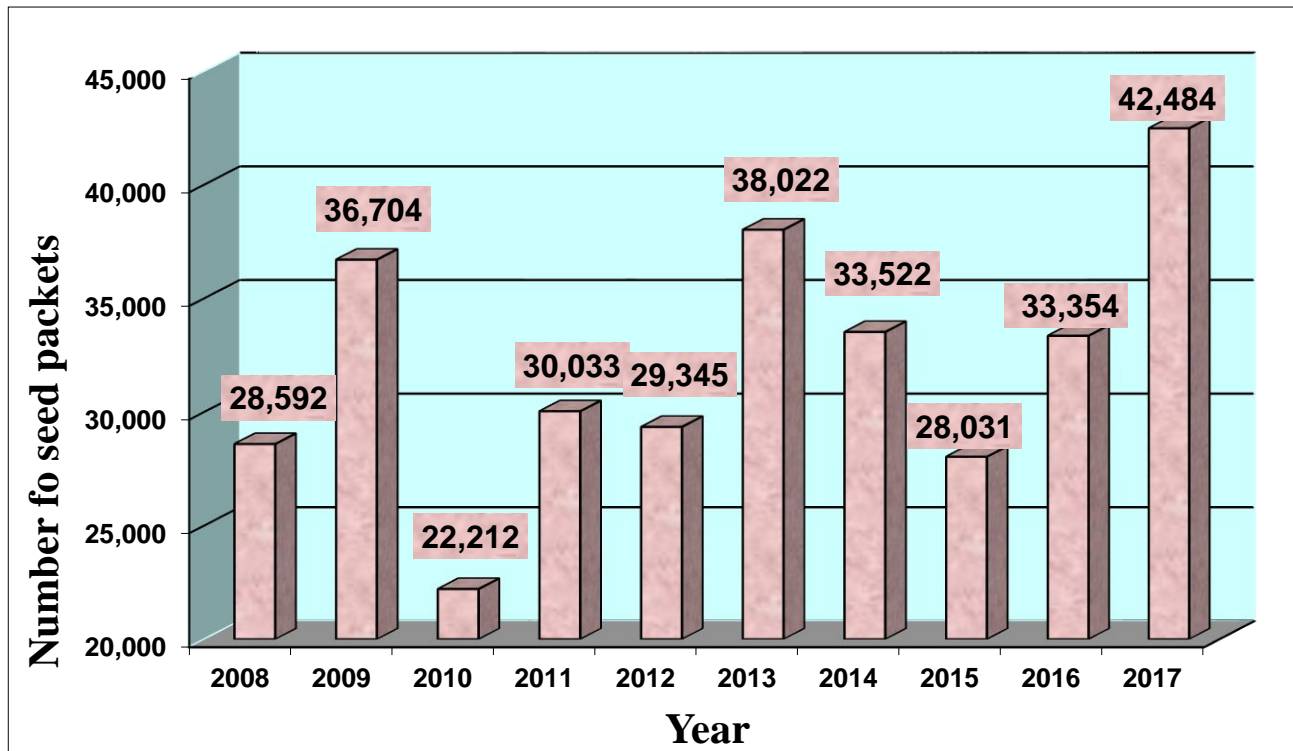
## Changes of total number of accessions managed by WRPIS since 2008





# Western Regional PI Station (W-006)

Serving the global plant research community  
by providing needed germplasm samples



Number of seed packets distributed by WRPIS each year since 2008

# Western Regional PI Station (W-006)

## Personnel changes:

### New Hire:

Mr. **Bo Gao** started on July 20, 2017 as the IT Specialist of the W6 Station.

### Retired:

Mr. **Dave Stout** retired in March 17, 2018 after working almost 48 years at the station. Dave started to work at the station when he was attending Washington State University (WSU), Pullman in 1970. He was hired by WSU as a Seed Curator to work at the station with a wide range of responsibilities from germplasm regeneration, characterization, seed cleaning, germination and seed storage and database management. Dave retired from WSU and joined USDA-ARS in 2004 as the seed storage and database manager. Dave is one of the group members who started the Germplasm Resources Information Network (GRIN) database and contributed substantially to the recent upgrade of the GRIN to GRIN-Global. Dave continues to help us by working half-time after officially retiring from the federal government. Dave is currently serving as a member of the NPGS GRIN-Global Advisory Committee representing the Pullman Station. We greatly appreciate Dave's dedication to managing plant genetic resources.

# Western Regional PI Station (W-006)

## Maintaining genetic integrity of NPGS alfalfa germplasm

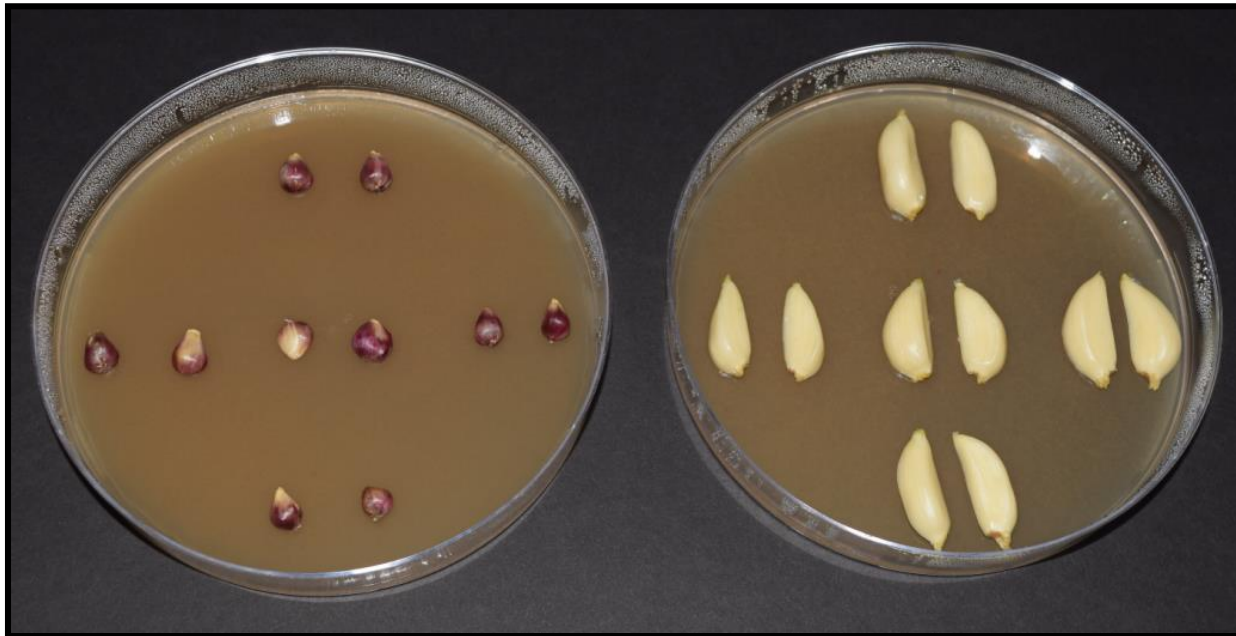


R1	R2	R3	R4	R5	R6
1	50	51	100	101	150
2	49	52	99	102	149
3	48	53	98	103	148
4	47	54	97	104	147
5	46	55	96	105	146
6	45	56	95	106	145
7	44	57	94	107	144
8	43	58	93	108	143
9	42	59	92	109	142
10	41	60	91	110	141
11	40	61	90	111	140
12	39	62	89	112	139
13	38	63	88	113	138
14	37	64	87	114	137
15	36	65	86	115	136
16	35	66	85	116	135
17	34	67	84	117	134
18	33	68	83	118	133
19	32	69	82	119	132
20	31	70	81	120	131
21	30	71	80	121	130
22	29	72	79	122	129
23	28	73	78	123	128
24	27	74	77	124	127
25	26	75	76	125	126

Genetically engineered feral alfalfa plants have been found in conventional hay fields on WSU Roza farm at Prosser, WA where our alfalfa germplasm is regenerated (left). Procedures of preventing transgene-flow have been implemented in our alfalfa regeneration to maintain the genetic integrity. No adventitious presence of transgene was detected from the seeds sampled from the red-circled sentinel plots (center) in our 2017 alfalfa regeneration plots.

# Western Regional PI Station (W-006)

## A new way to lower *Fusarium* infestation for garlic regeneration



We demonstrated that *Fusarium proliferatum* infestation can be dramatically lowered by planting bulbils instead of seed cloves for regeneration of garlic.

# Western Regional PI Station (W-006)

## W6 table beet collection diversity



Root flesh color



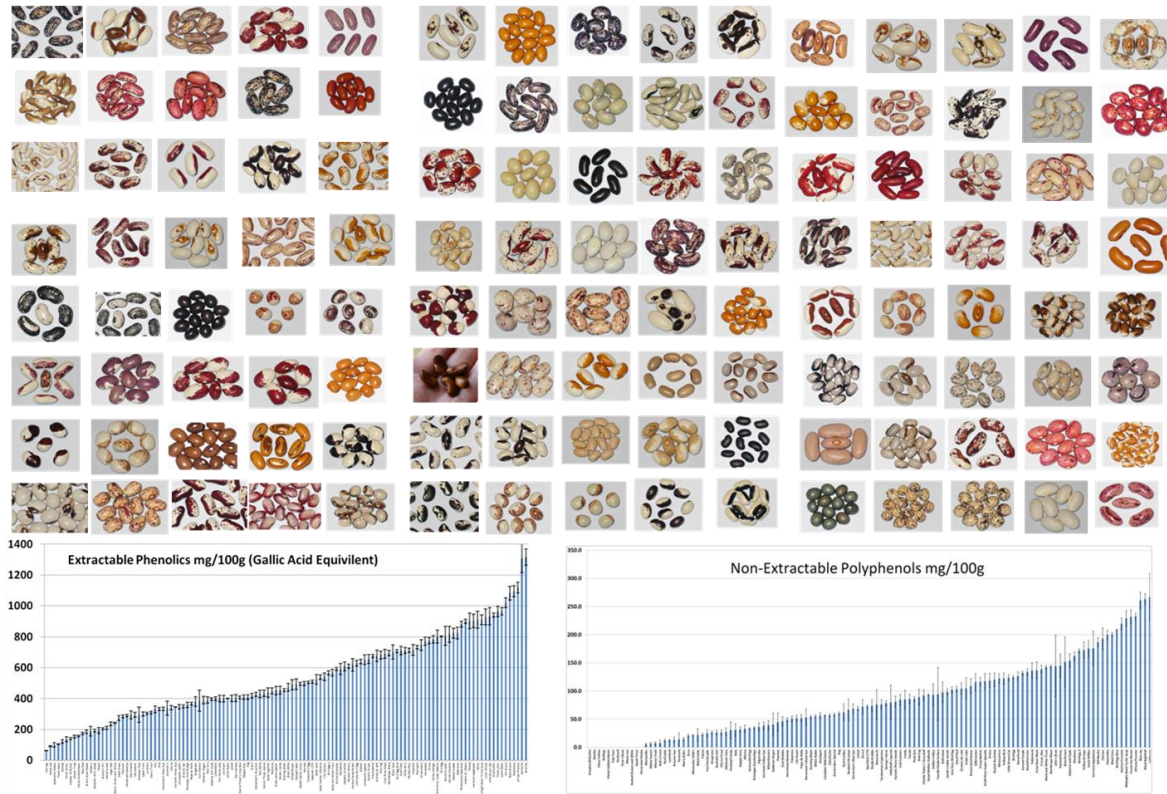
Root shape, leaf density and color





# Western Regional PI Station (W-006)

## New descriptors for phenolic content in bean accessions



We analyzed 120 Heirloom Beans for protein, extractable phenolics and non-extractable proanthocyanidins. There were 2 to 3-fold differences even within market classes of Red and Black beans. Some of the data has been entered into our GRIN Global database.



# Western Regional PI Station (W-006)

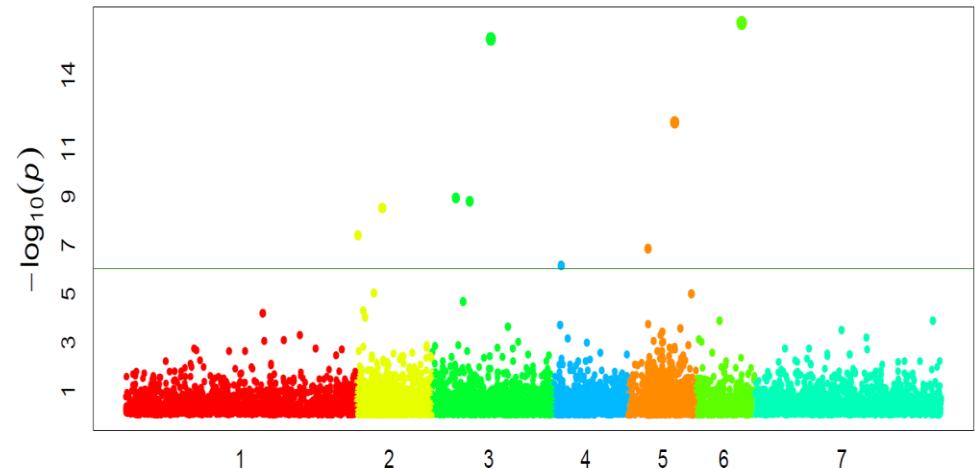
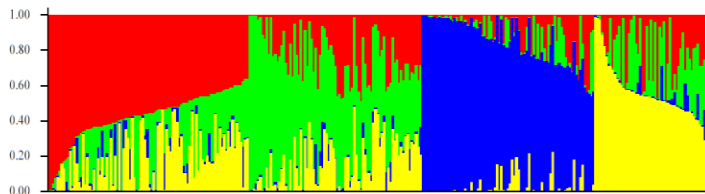
## Completed a GWAS with the USDA lentil core collection

- 10,052 SNPs from GBS
- 2 years, 2 locations, RCBD
- Significant markers identified

As a part of the Ph.D. dissertation of Dr. Md Nurul Amin, native of Bangladesh, attending Washington State University.



Daystoflowering



# Western Regional PI Station (W-006)

## Using solar powered fans in beet pollen proof regeneration cages



Air circulation by the solar powered fan in beet pollen proof regeneration cages can alleviate flower stalk tip die-back.

We used this fan system that is a 10 watt, 12 v solar panel with a dc connection to power a 12 inch high velocity fan at our Pullman Farm for the 2017 field season and will continue to use it in the future.



# Western Regional PI Station (W-006)

## A new pathogen of stored sugar beet roots

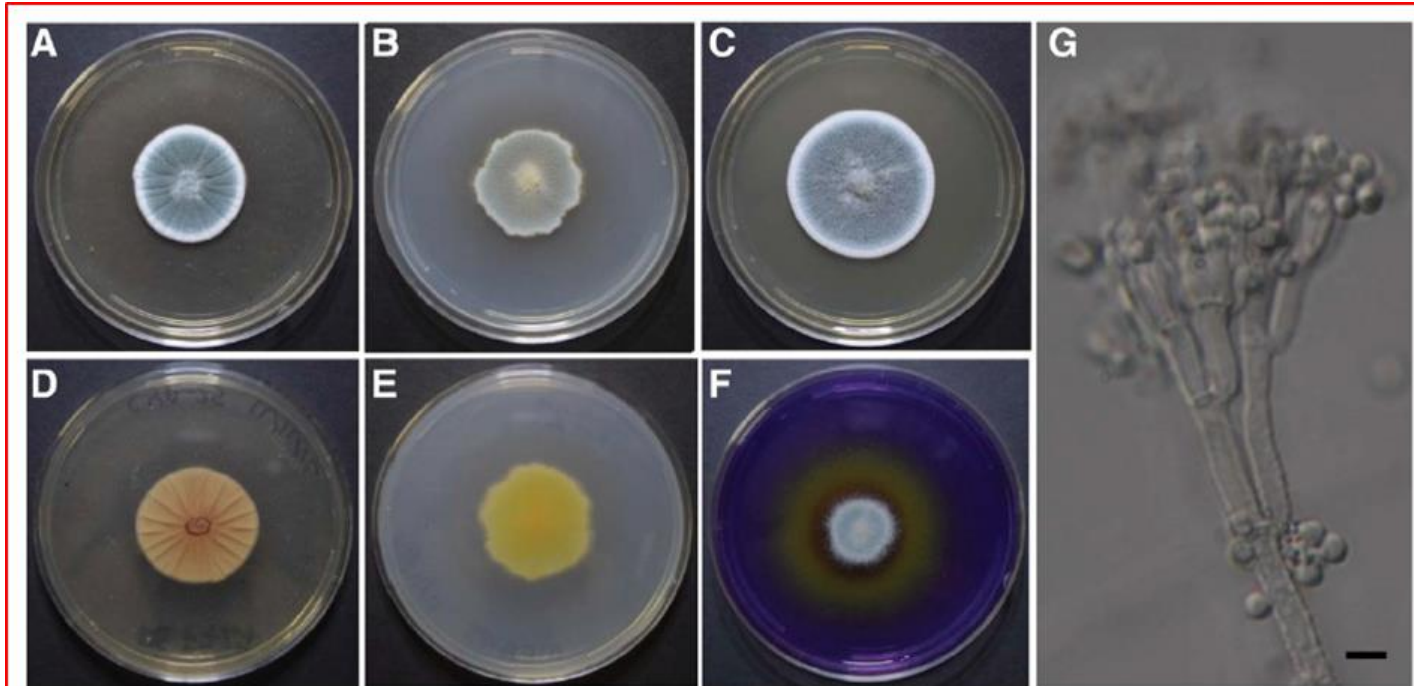


Fig. 1. Growth of *Penicillium cellarum* sp. nov., isolate F727 (holotype) at 25°C after 7 days on **A**, Czapek yeast autolysate agar (CYA), **B**, malt extract agar (MEA), **C**, yeast extract sucrose agar, **D**, CYA reverse, **E**, MEA reverse, and **F**, Creatine sucrose agar. Yellow hallow indicates moderate acid production. Penicillus (**G**), bar = 5 µm.

In collaborating with an ARS scientist at Kimberly ID, we identified a new pathogen of stored sugar beet roots and named it *Penicillium cellarum* sp. nov., together with demonstrating its pathogenicity and environmental preferences.



# Western Regional PI Station (W-006)

## VIP visit



ARS Associate Administrator Dr. Steven Kappes and ARS PWA Area Director Dr. Robert Matteri visited W6 Seed Storage Facility and the common bean greenhouse on April 20, 2018. We truly appreciate the support from our senior leaders!