



# Regional Plant Introduction Stations – 2023 Update

Melanie Harrison

USDA-ARS, Plant Genetic Resources Conservation Unit

## North Central Regional Plant Introduction Station

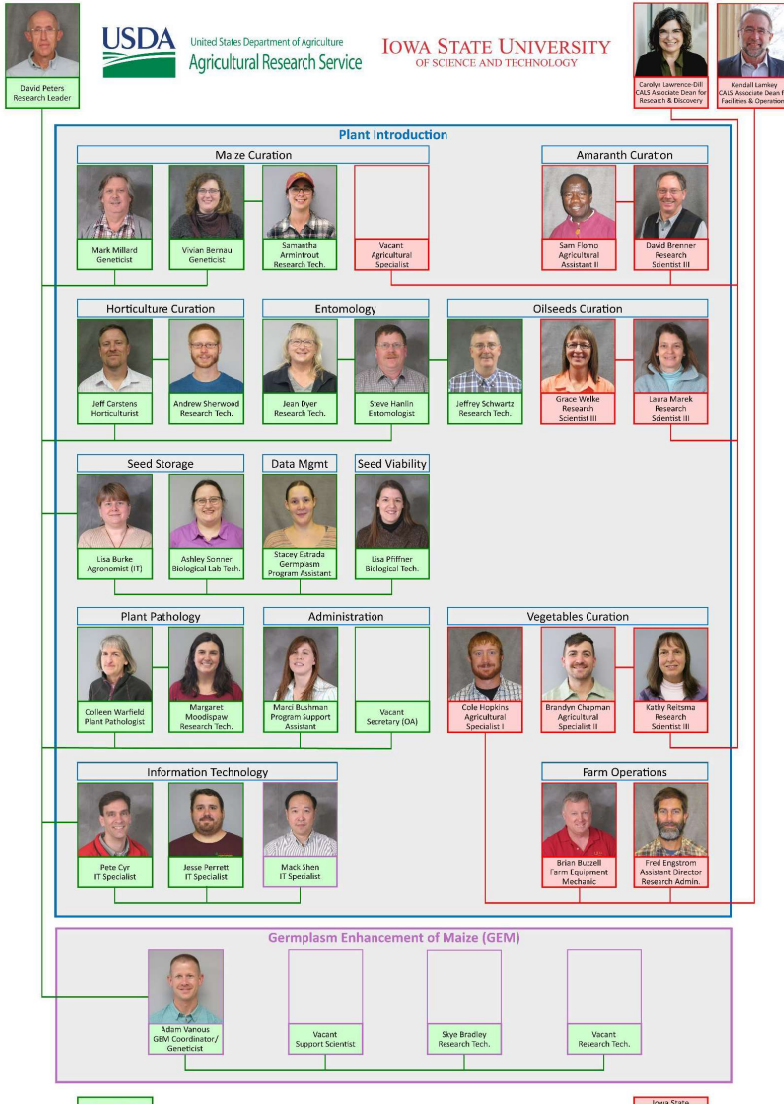
Conserving and Providing Plant Genetic Resources for Agricultural Success



NC-007  
Ames, Iowa



## North Central Regional Plant Introduction Station Staff



## PIRU Organization & Staffing

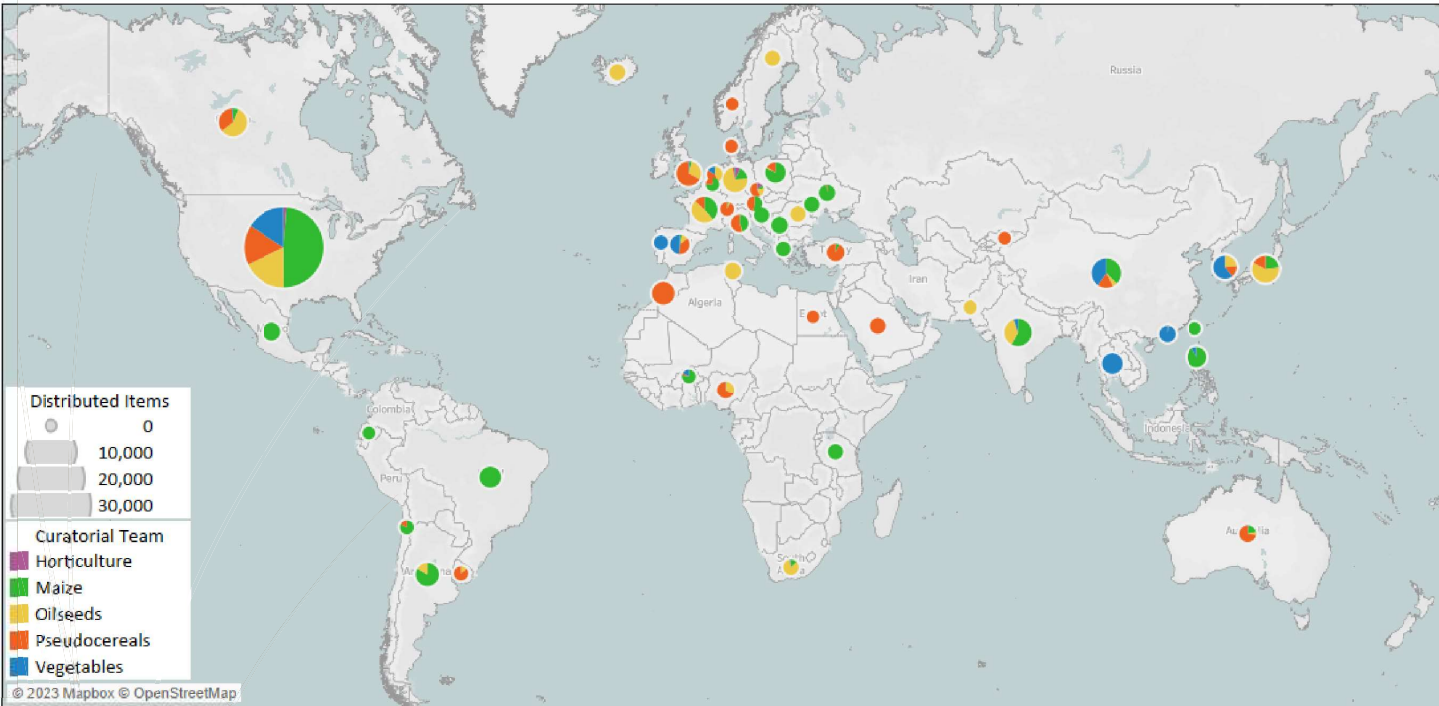
### ❖ Plant Introduction Group

- 29 Total Full-time Staff (20 ARS, 10 NC-007)
  - 2 open positions
- Curation Staff - 14
- Plant Path & Pollinator Management - 4
- Germplasm, Storage, Distribution & Viability Testing - 4
- IT/GRIN-Global Programing & Support - 3
- Site Management and Support – 5

### ❖ Germplasm Enhancement of Maize (GEM) Project

- 4 ARS Staff
  - 3 open positions
- Maize genetic diversity pre-breeding program
- Public/Private Partnership
- 58+ Cooperators (Public & Private, Domestic & International)
- Released lines added to NPGS Maize collection

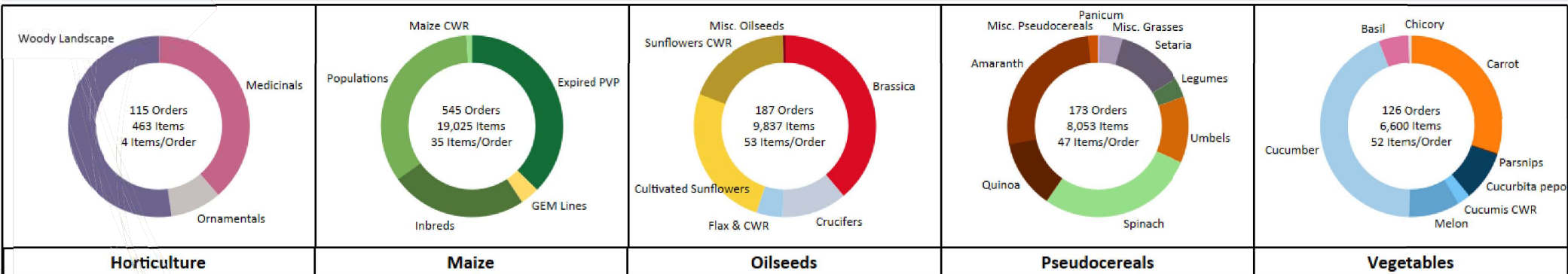
## 2022 - Worldwide NCRPIS Germplasm Distributions



## 2022 - NCRPIS External Germplasm Distribution Summary

Curatorial Team	Orders		Order Items		Avg. Items per Order	
	U.S.A.	Int'l	U.S.A.	Int'l	U.S.A.	Int'l
Horticulture	104	11	368	95	4	9
Maize	451	94	13,942	5,083	31	54
Oilseeds	118	69	5,212	4,625	44	67
Pseudocereals	120	53	4,588	3,465	38	65
Vegetables	84	42	4,580	2,020	55	48
<b>NCRPIS Distributions</b>	<b>812</b>	<b>242</b>	<b>28,690</b>	<b>15,288</b>	<b>35</b>	<b>63</b>

## 2022 - Crop Distributed Order Items by NCRPIS Curatorial Group



# Amaranth, Millet, Miscellaneous Umbels

Curator: David Brenner



- ❖ 9,538 Accessions in collection
  - 86% Collection available
- ❖ 6 Accessions added
  - 3 *Amaranthus*, 2 quinoa, & 1 *Dalia*
- ❖ Spinach collection requests remained strong
- ❖ Parsley accession viability falling
  - 116 (62%) below 70% germination
  - Increased focus for regeneration in 2023/2024
- ❖ Regeneration kept on track
  - 167 Accessions regenerated
  - Collaborative spinach regeneration in California
- ❖ 2 Grain Amaranth Varieties released (Iowa State)
  - 1 meter height
  - Lodging resistant

# Woody Landscape, Ornamentals, & Medicinal

Curator: Jeff Carstens



- ❖ 4,052 Accessions in collection (>200 genera)
  - 61% Accessions available
- ❖ 71 Accessions added to collection
  - 27 Medicinal
  - 6 Ornamentals
  - 38 Woody landscape
- ❖ 105 Accessions regenerated
  - 32 Medicinal
  - 10 Ornamentals
  - 63 Woody landscape
- ❖ Collection trips resuming
  - Ash collection to preserve diversity before Emerald Ash Borer destroys western species

# Sunflowers & Oilseeds

Curator: Laura Marek



- ❖ Sunflower collection requests remain strong
- ❖ 12,967 Accessions in collection
  - 90% Collection Accessions Available
- ❖ 47 Accessions add to collection
  - 25 *Camelina macrocarpa*
  - 10 *Thlaspi arvense*
  - 3 *Eupatorium perfoliatum*
  - 10 *Helianthus sp.*
- ❖ 216 Accessions regenerated
  - 49 Flax
  - 85 Brassica
  - 82 Sunflower
- ❖ Collaborative regenerations continued with Parlier, CA

# Maize

Curators: Vivian Bernau & Mark Millard



- ❖ Germplasm demand remains strong
  - 91% Collection accessions available
- ❖ 159 Accessions added to collection
  - 66 Donated by Illinois Foundation Seed
- ❖ 290 Accessions regenerated
  - 30 Public inbreds
  - 78 Ex-PVP
  - 165 Populations (Tropical & Highland)
  - 3 Teosinte
- ❖ Wild relative regeneration remains a challenge
- ❖ Tropical populations regeneration will be major challenge
  - Viability dropping (associated drop in diversity)
  - Tropical site options limited



# Vegetable Crops (Cucurbits & Daucus)

Curator: Kathy Reitsma



- ❖ Germplasm requests remain strong
  - 75% Collection accessions available
- ❖ 8 Accessions added to collection
  - 3 *Cucurbita pepo*
  - 2 *Cucurbita melo*
  - 2 *Ocimum*
  - 1 *Daucus*
- ❖ 171 Accessions regenerated
  - 31 Chicory
  - 44 *Cucumis*
  - 30 Cucurbita
  - 42 *Daucus*
  - 24 *Ocimum*
- ❖ Collaborative *Daucus* regenerations with private industry

# USDA-ARS Plant Genetic Resources Unit

## Northeast Regional PI Station (NE9)



**Clonal:** Ben Gutierrez (apple & tart cherry) and Erin Galarneau (grape)

**Vegetable:** Rebecca Povilus (starting May 2023)

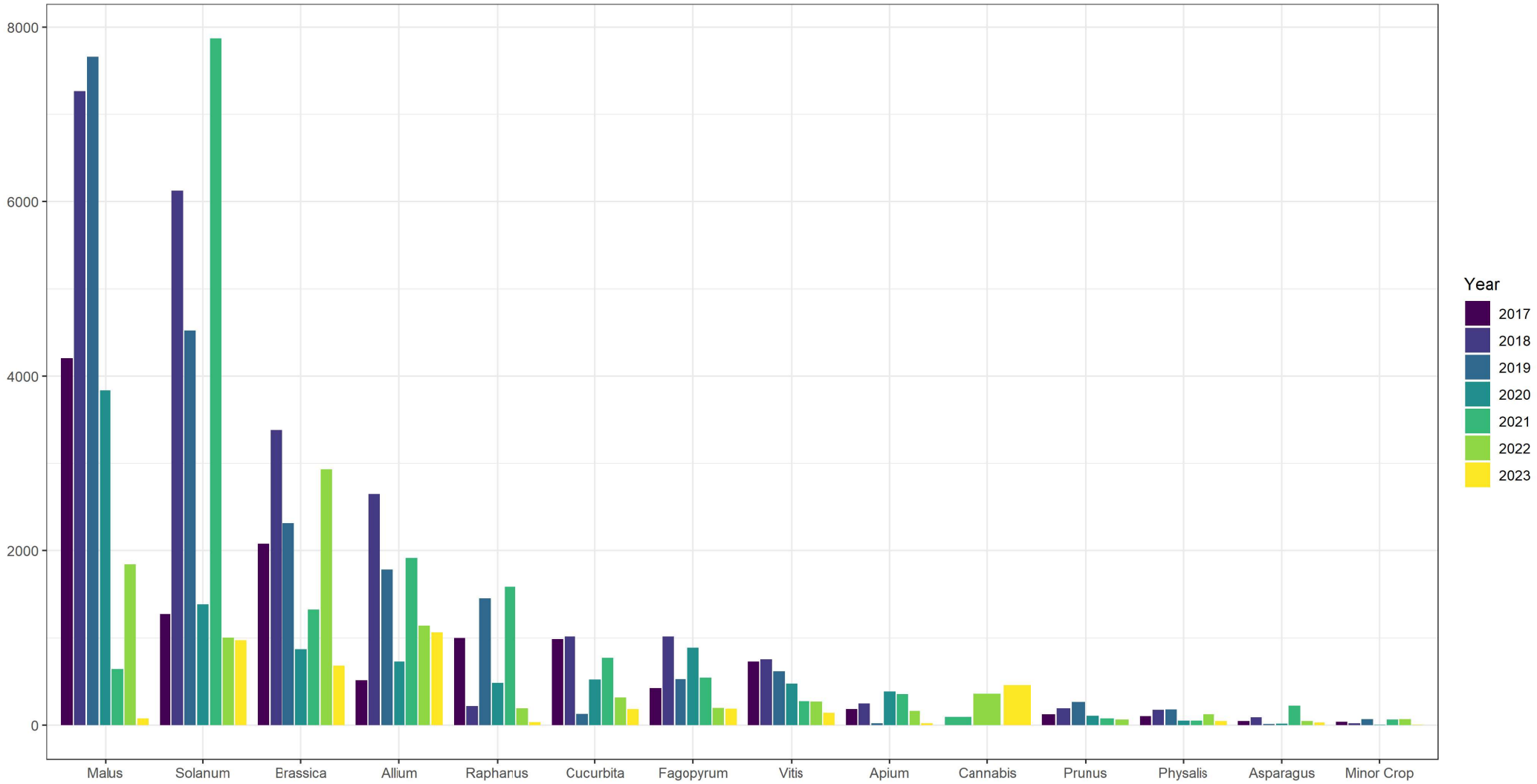
- tomato
- onion
- radish
- winter squash
- brassica
- other vegetables

**Hemp:** Zachary Stansell & Tyler Gordon

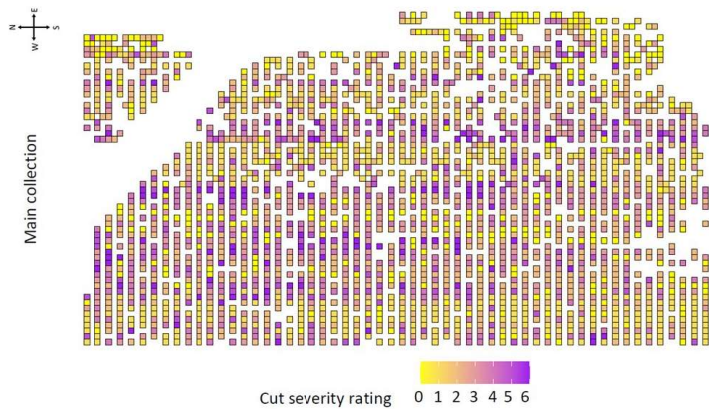
- Tyler joined in May 2022



Distribution of NE9 Geneva Germplasm



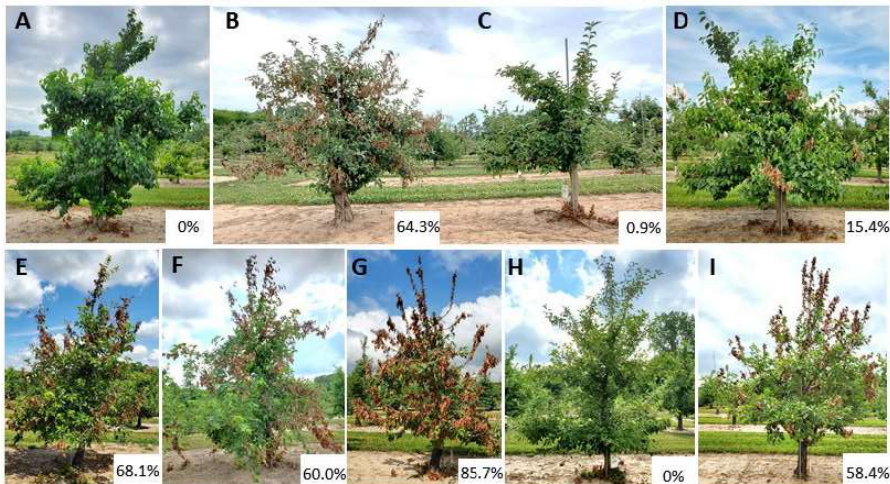
# Fire Blight in the USDA Apple Collection



2020



2021



- Restricted distribution
- Expanded chemical program
- Increased propagation and cryopreservation

Dougherty et al. *Agronomy* (2021) 11:1 144

# Cryotherapy for Apple Fire Blight

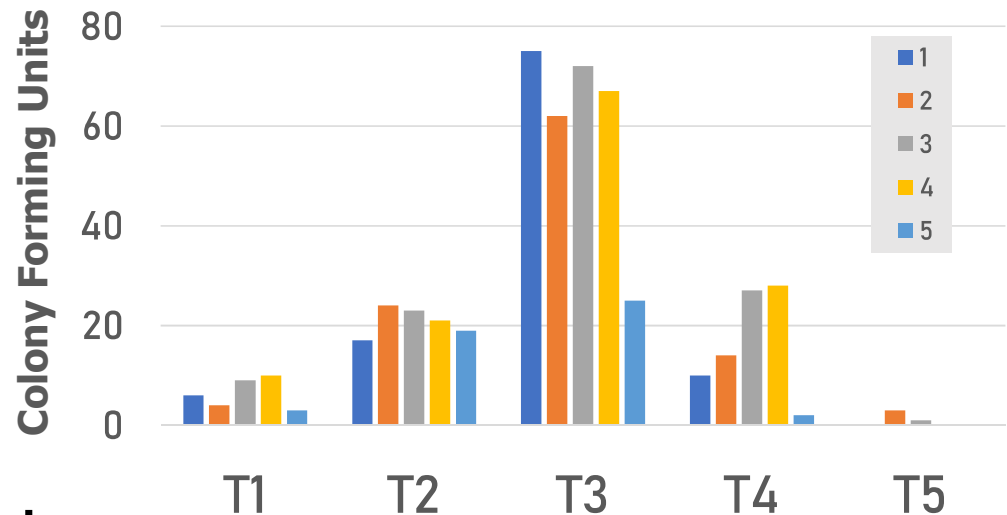


## Testing on 'Gala' (fire blight susceptible)

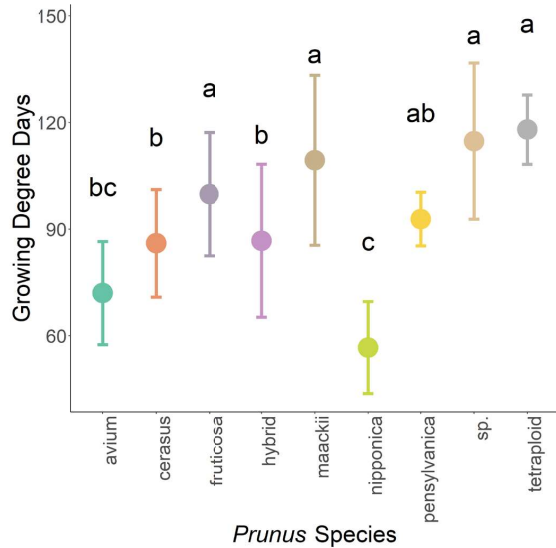
### 5 treatments:

- T1 = No inoculation**
- T2 = Inoculation and no cryotreatment**
- T3 = Inoculation + dry only**
- T4 = Inoculation + dry + freeze (-30C)**
- T5 = Inoculation + full cryopreservation**

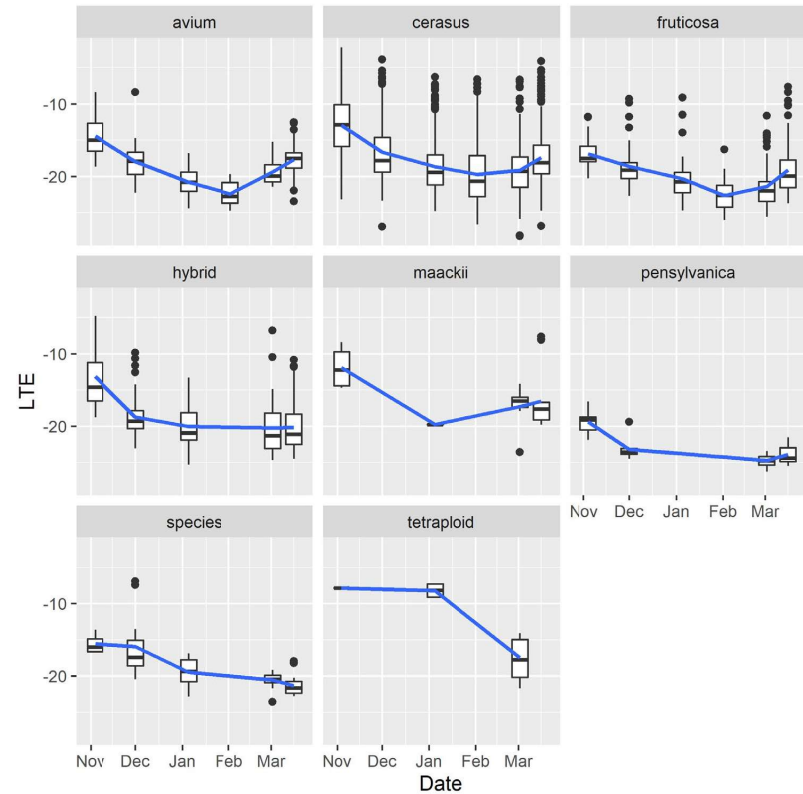
**Buds cultured for *Erwinia amylovora***  
**Subset of full cryopreserved buds grafted to determine viability**



# Tart Cherry Cold-Hardy Evaluation



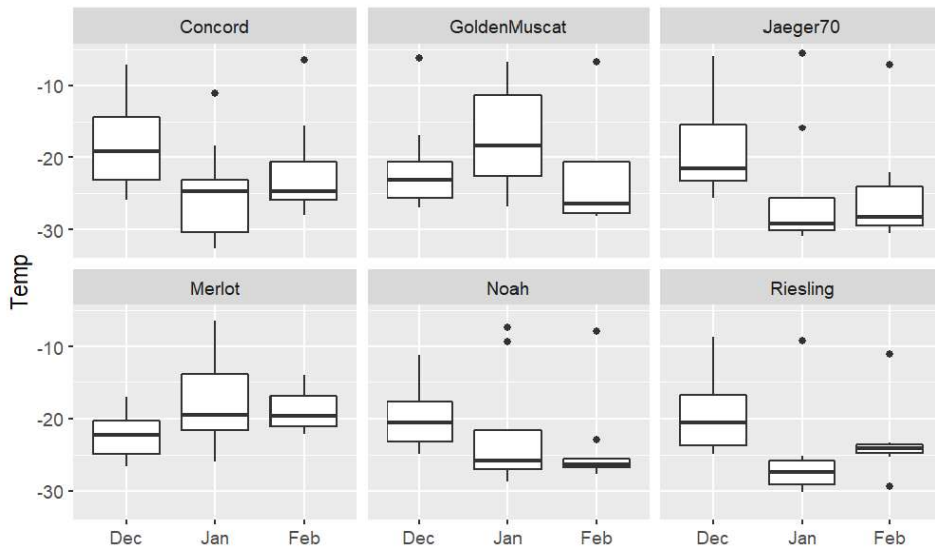
Bloom date scored over 3 years



Low Temperature Exotherm (LTE) assays determine cold hardy acclimation and deacclimation in *Prunus* germplasm. This adaptability sets the limits for crop production in cold climates.

# Cold Hardy *Vitis* Evaluation and Documentation

Low Temperature Exotherm (LTE) assays started to determine the cold hardy acclimation in *Vitis* germplasm.



- Began assessing powdery mildew and downy mildew resistances for the full collection (high-throughput phenotyping).
- Leading update to Grape Crop Vulnerability statement.
- Fruit quality evaluation has begun on 450 accessions from Geneva and Davis grapevine collections.



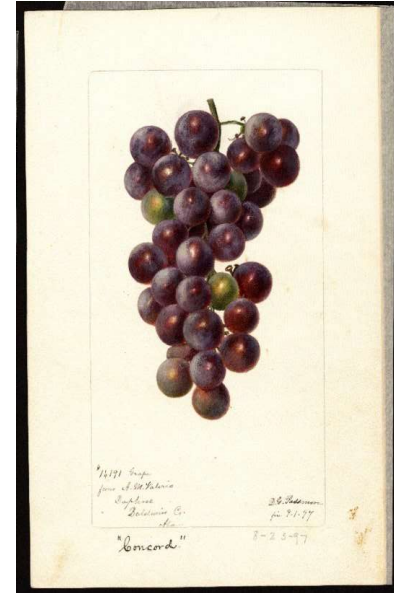
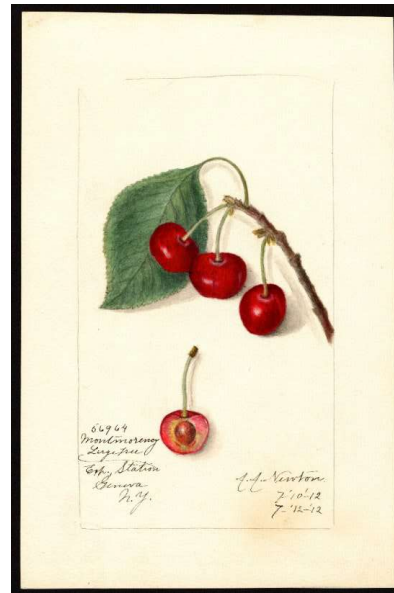
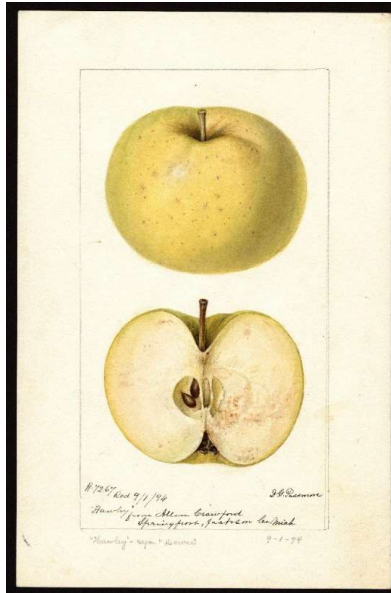
125 regenerations underway in 2022-2023 and 6 acquisitions in 2022.



Implementing virtual inventory for detailed distribution information.



Collecting for fruit quality evaluations.



**USDA-PGRU Tour of the  
Apple, Tart Cherry and Grape Collections  
Saturday, Sept. 16, 2023, 9:00 AM**

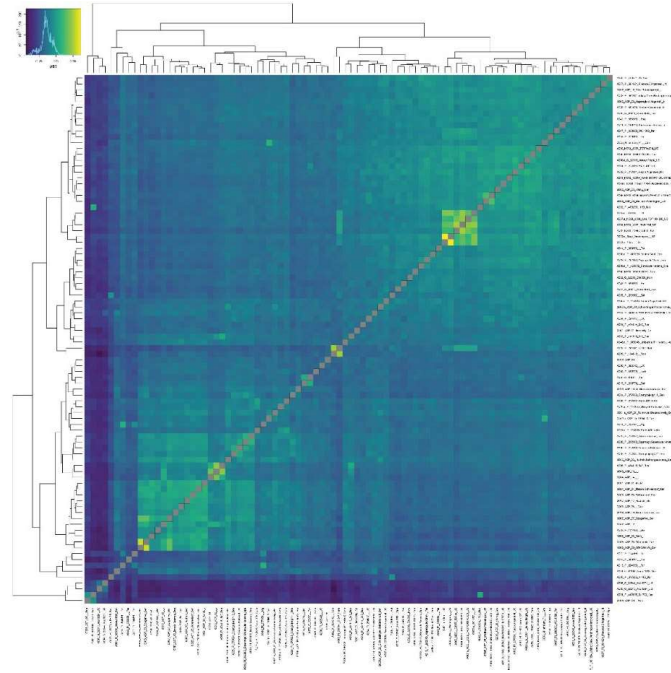
**Tart Cherry Day  
Saturday, July 15, 2023, 9:00 AM**



# Vegetable Germplasm Collections

## Germplasm regeneration, collection, and outreach highlights:

- Hiring of New Vegetable Curator: Becky Povilus
- Development and application of new distribution, regeneration, and evaluation SOPs.
- Uploaded and linked 20K passport and other metadata to NE9 germplasm
- Collaborative evaluation of tomato, bottle gourd, asparagus, and physalis collections underway
- Rescue and regeneration of ~400 accessions underway.



Asparagus diversity analysis



New curator Becky Povilus

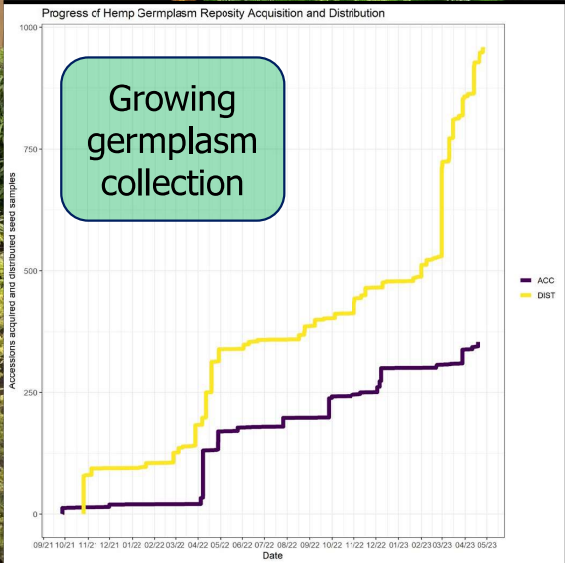
# Hemp germplasm repository:

- Acquired 355 accessions and distributed ~ 1000 seed samples
- Running replicated germplasm trials in 6 environments (AL, CA, LA, OR, WA, NY)
- Developing inbred breeding lines
- Added ~ 75 K datapoints to GRIN
- Made 40 accessions now available
- Assisted development of the first Cannabis Pangenome

Pollen collection device invented at PGRU



Cannabinoid trichome analysis



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# The Western Regional W-6 Plant Introduction Station

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# Western Regional Plant Introduction Station



People located at Central Ferry

People hired through WSU, Pullman Farm

Kurt Tetrick  
CF Farm Manager

Jennifer Morris  
Farmer

Julia Zaring  
Pullman Farm Manager

Richard Koenig  
WSU CSS Chair\*

Renan Uhde  
WSU Postdoc

Marilyn Warburton  
WRPIS RL

Carla Olson  
PSA

IT Specialist  
Vacancy

Wayne Olson  
Jack of All Trades

Vacant Seed Storage  
Technician

Alec McCall  
Farm Technician

Jason Newell  
Seed Cleaning Tech

Vacant Plant  
Technician

Shari Lupien Path.  
Tech/Lab Manager

Melissa Scholten  
Seed Germ. Tech.

Barbara Hellier  
Horti Crops Curator

Sarah Dohle  
Phaseolus Curator

Paul Galewski  
Agronomy Curator

Lisa Taylor  
Seed Storage Manager

Clare Coyne  
Food Legumes Curator

Brian Irish  
Forage Crops Curator

Long-Xi Yu  
Alfalfa Geneticist

People located at Pullman

People located at Prosser

Alex Cornwall  
Horti Crops Tech

Dawn Tachell  
Phaseolus Tech

Zeke Brazington  
Agronomy Tech

Britton Bourland  
CSFL Tech

Estela Cervantes  
TFC Tech

Martha Rivera  
Alfalfa Technician

David Van Klaveren  
Beta Crop Tech

Greenhouse  
Technician Vacancy

Bailey Hallwachs  
SOS Coordinator

Lyle Wallace  
ARS Postdoc

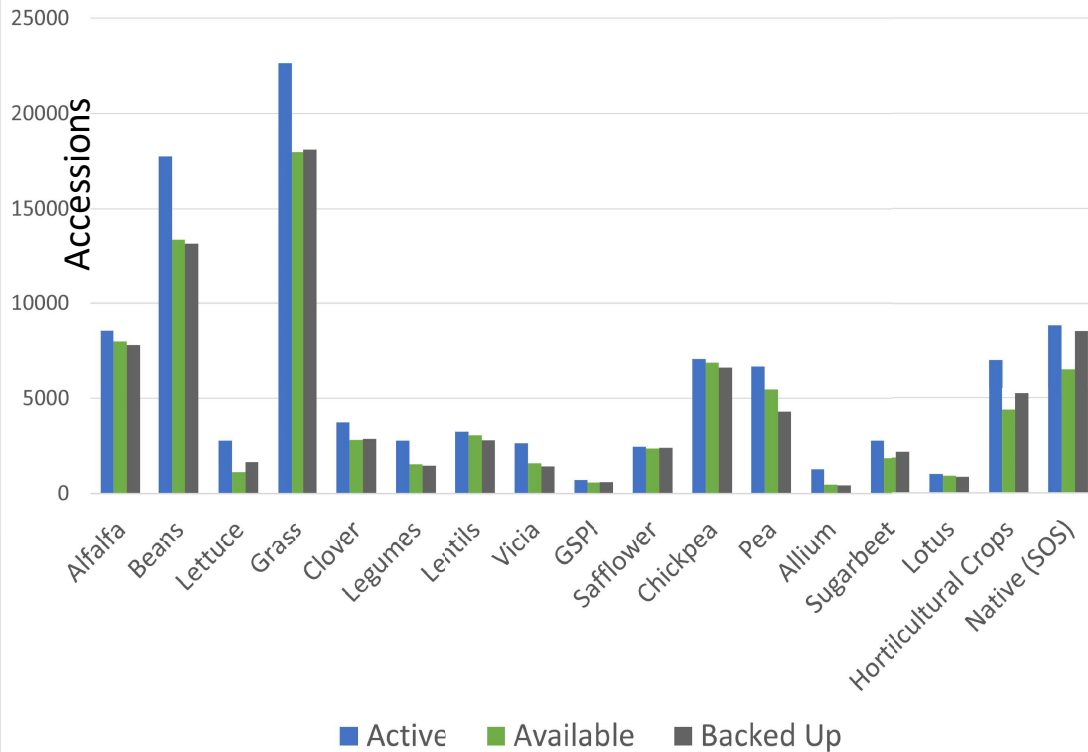
Jessie Prieto  
Farmer

Jose Luis Godinez  
Farmer

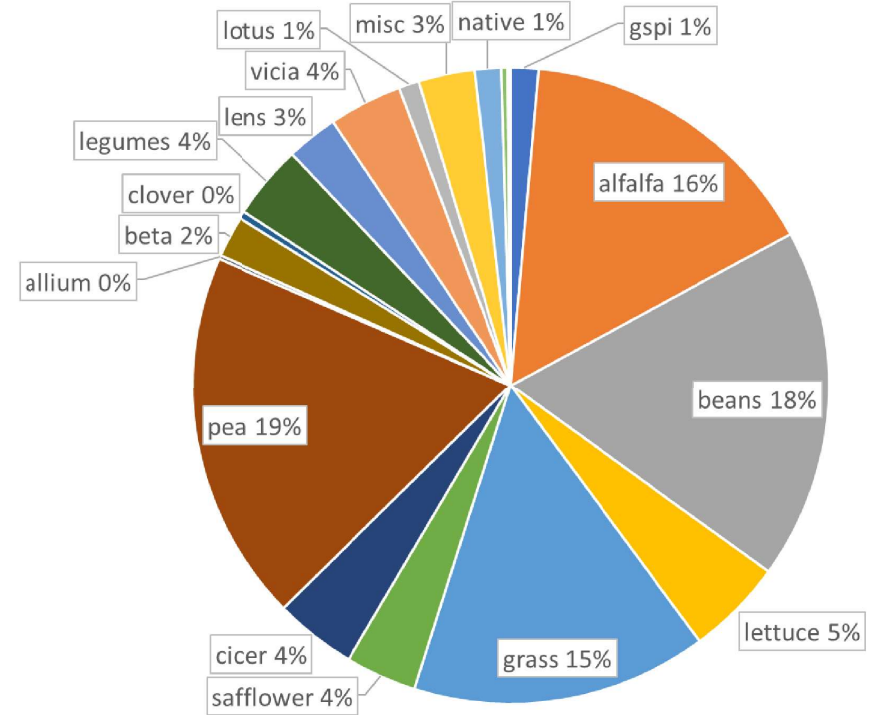


# 2022 PGITRU PGR Statistics

Available Accessions: 77% Backed Up Accessions: 77%



WRPIS (W6) Distributions 2022: 34,861 items



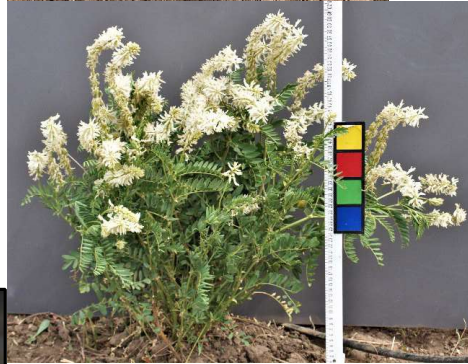
# Program updates and challenges

- Two curators (P. Galewski, Agronomy and S. Dohle, Phaseolus) were hired in the summer of 2022. Three technicians (Z. Brazington, Agronomy, D. Van Klaveren, Beets and ??????, greenhouse maintenance) were hired in 2022 and 2023. Hort. Crops curator, B. Hellier, retired in June 2022 and the position is being filled by a Pathways PhD student, A. Cornwall.
- Current vacancies include an IT specialist, the Hort. Crops technician, a farm technician, and two seed technicians (the latter 3 paid by W-6).
- Due to staffing shortages and turnover in many parts of our unit over several years, there is a backlog of data and inventory to enter and put away, and this is likely to continue through 2023.

# Horticultural Crops and *Beta*

- Regeneration:
  - *Beta* (beets)- field and greenhouse plots
  - Lettuce – *L. sativa* field nursery and *L. sativa* species greenhouse growouts
  - Misc collections – 4 field nurseries
  - *Allium*- seed plots and garlic
- Characterization of 30 sugarbeet accession to 5 plant pests/diseases.
- *Lactuca* sp. identification via genome region study.

(images clockwise from top left: PI 540597, *Beta maritima*; planting Misc seedlings in Pullman; W6-37344, *Astragalus bisulcatus*; W6-20282, *Allium caeruleum*; lettuce transplants ready to plant to field; *Lactuca* species plants in greenhouse w/ *L. orientalis* flower inset.)



# Agronomy Crops -Temperate Grasses and Safflower

- Regeneration
  - ~22,000 accessions (grass) ~2,400 safflower accessions.
- Characterization
  - Prioritize a few species within collection (>1,100) and explore interspecific variation.
- Develop tools and knowledge to improve ex-situ genetic resource conservation
  - Provide clarity to the collection and help inform the management of genetic diversity
- Strengthen collaborations with Stakeholders (Forage, Turf and Grassland Restoration)
  - BLM SOS, NRCS, ARS
  - Public and Private Breeders





# Phaseolus (bean) program

- New curator Sarah Dohle – started in August
- Co-PI on USDA NIFA SCRI – Development of Genomic Resources to Accelerate Lima Bean Breeding for Consumer Quality and Agronomic Traits \$3.3 M 2022-2026
  - Characterizing (genotype and phenotype) entire available lima bean collection ~700 accessions
- Collaborator on USDA NIFA SCRI – POPBEANS SREP: Protein-rich Wholesome Popping Beans to Enhance Agricultural Production, Nutrition and Sustainability. (pending)
  - Characterize and regenerate 100 accessions of nuña (Peruvian popping beans, *P. vulgaris*)

# Cool Season Food Legumes

Leveraging phenomics & plant genetic resources for plant-based protein market

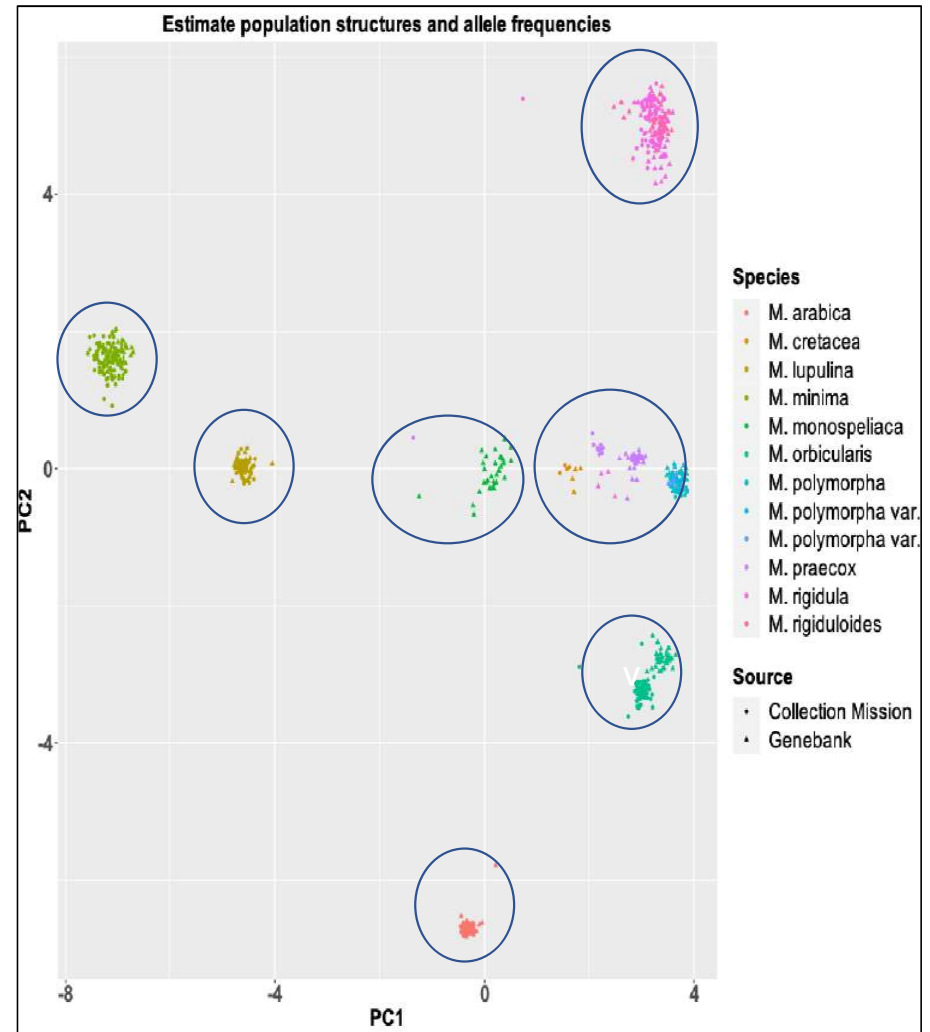
- **Objective: High yielding pulses with higher seed protein concentrations**
- Pea, Coyne, McGee, Warburton
- Chickpea, Coyne, Warburton
- Lentil, Warburton, Coyne



2023 autonomous Earthsense Ground robot with 5 cameras



# Temperate-adapted Forage Legume program



# Enhancing Resistance to Biotic and Abiotic Stresses in Alfalfa



Well watered

Water deficit

Evaluation of drought resistance alfalfa in field trials identified resistant pre-breeding lines which were transferred to the Corteva alfalfa breeding program

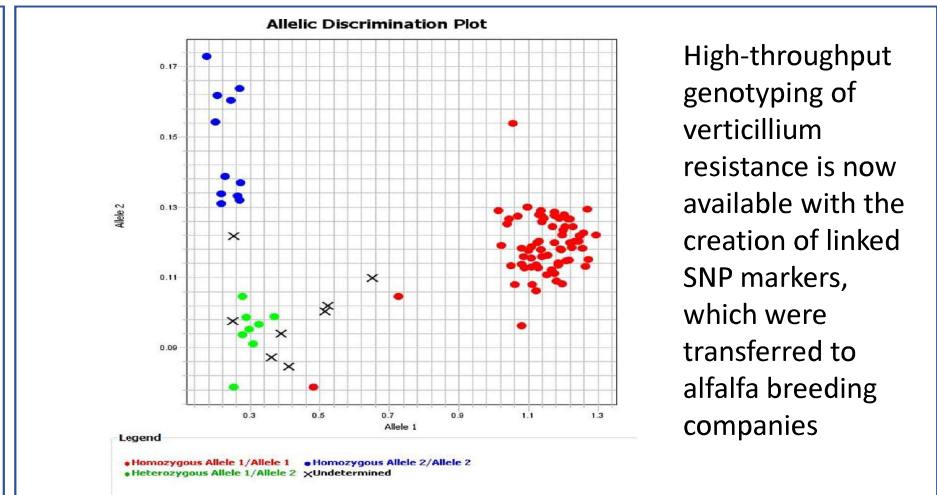
Control (non infection)      Infected with VW

without gene    With gene    without gene    With gene

A verticillium wilt disease resistance gene was identified and validated for effect in transgenic alfalfa plants



Evaluation of salt tolerance in alfalfa identified salt resistant and susceptible pre-breeding lines and accessions





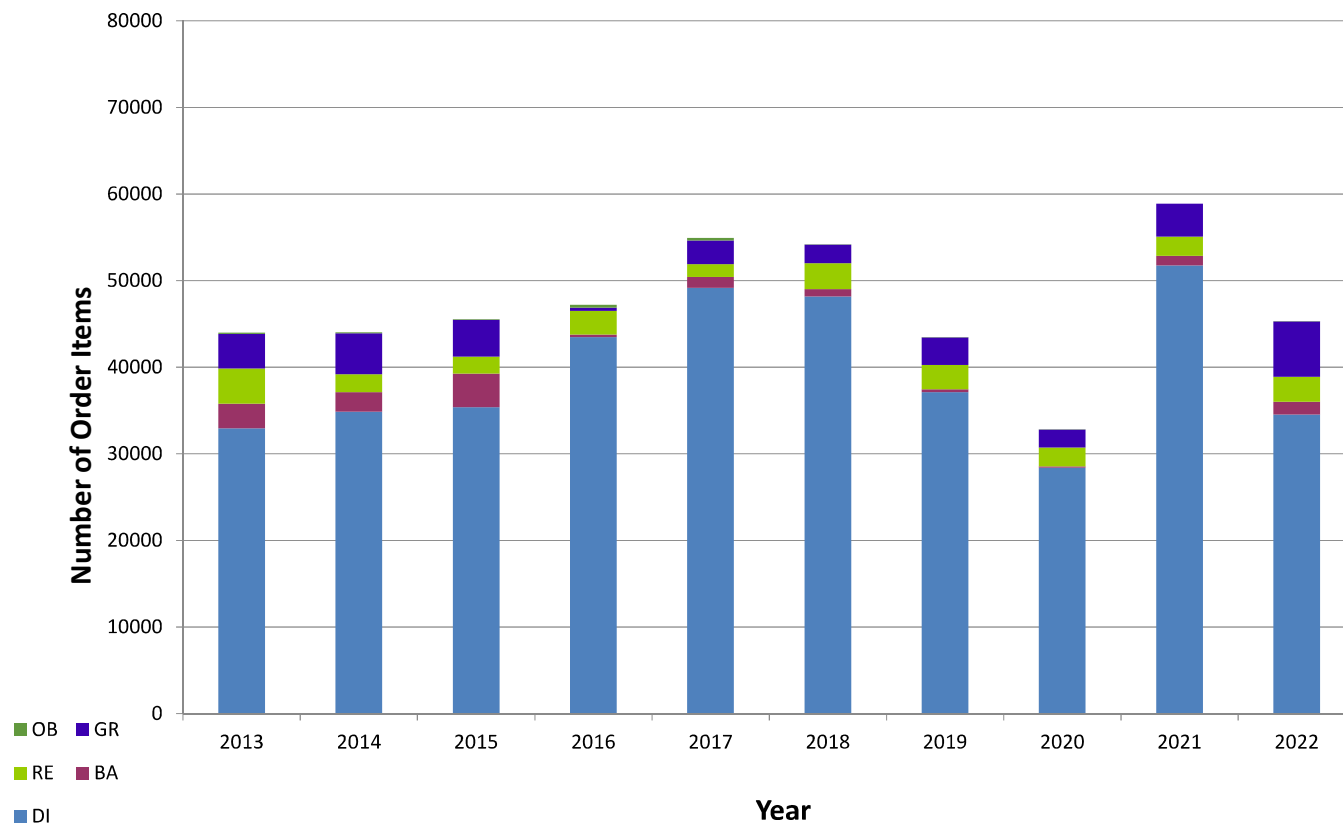
# Southern Regional S-009 Project Plant Genetic Resources Conservation Unit Griffin, GA





- The PGRCU collection totals 104,831 accessions of 1596 species and 279 genera with 88.2% available for distribution and 95% backed up at Ft. Collins, CO.
- A total of 34,540 accessions were distributed worldwide in 2022. Of these, 5944 accessions were distributed to researchers in the S-009 Region. Sorghum, cowpeas, pepper, and watermelon were the most requested crops.
- Currently, 88,119 accessions or 88.4% of the seeded accessions in the collection are stored at  $-18^{\circ}\text{C}$ . Seed longevity is improved by storage in  $-18^{\circ}\text{C}$  rather than  $4^{\circ}\text{C}$ .

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



## S-009 Activities

- The S-009 Regional Technical Advisory Committee was held on August 29, 2022, in Griffin, GA and was hosted by Soraya Bertioli, 2022 S-009 Chair and Representative from Georgia. There were 22 participants who attended in person and an additional 14 participants who joined virtually. The hybrid format was very successful and feedback during the meeting was favorable to continue this format for future meetings.
- The Southern Association of Agricultural Experiment Station Directors voted to increase the S-009 budget to cover employee raises which was greatly appreciated.





# Characterization and Evaluation

Wang, M.L., Tonnis, B.D., Chen, C., Li, X., Pinnow, D.L., Tallury, S.P., Stigura, N.E., Pederson, G.A., Harrison, M.L. 2022. Evaluation of variability in seed coat color, weight, oil content, and fatty acid composition within the entire USDA-cultivated peanut germplasm collection. *Crop Science*. 62:2332-2346. <https://doi.org/10.1002/csc2.20830>.

Jarret, R.L., Dudchenko, O., Weisz, D., Khan, R., Aiden, E. 2022. The genome sequence of *Citrullus naudinianus* (Sond.) Hook. f.. *Cucurbit Genetics Cooperative Report*. 44:4-6.

Mariod, A., Jarret, R.L. 2022. Antioxidant, antimicrobial and antidiabetic activities of *Citrullus colocynthis* seed oil. In: Mariod, A., editor. *Multiple Biological Activities of Unconventional Seed Oils*. London, UK: Academic Press. p. 139-146. <https://doi.org/10.1016/B978-0-12-824135-6.00005-2>.

Cantrell, C.L., Jarret, R.L. 2022. Bulk process for enrichment of capsinoids from capsicum fruit. *Processes*. 10(2):305. <https://doi.org/10.3390/pr10020305>.

Munoz-Rodriguez, P., Wells, T., Wood, J., Carruthers, T., Anglin, N.L., Jarret, R.L., Scotland, R. 2022. Discovery and characterisation of sweetpotato's closest tetraploid relative. *New Phytologist*. 234:1185-1194. <https://doi.org/10.1111/nph.17991>.

# Characterization and Evaluation

Solberg, S.O., Van Zonneveld, M., Rakha, M.T., Taher, D.I., Prohens, J., Jarret, R.L., Van Dooijeweert, W., Giovannini, P. 2022. Global strategy for the conservation and use of eggplants. Workshop Proceedings. <https://edepot.wur.nl/576163>.

Morris, J.B. 2022. Multivariate analysis of butterfly pea (*Clitoria ternatea* L.) genotypes with potentially healthy nutraceuticals and uses. *Journal of Dietary Supplement*. <https://doi.org/10.1080/19390211.2021.2022821>.

Morris, J.B., Tonnis, B.D., Wang, M.L., Bhattari, U. 2022. Genetic diversity for quercetin, myricetin, cyanidin, and delphinidin concentrations in 38 blackeye pea (*Vigna unguiculata* L. Walp.) genotypes for potential use as a functional health vegetable. *Journal of Dietary Supplement*. <https://doi.org/10.1080/19390211.2022.2077881>.

Wang, M.L., Tonnis, B.D., Li, X., Morris, J.B. 2023. Generation of sesame mutant population by mutagenesis and identification of high oleate mutants by GC analysis. *Plants*. 12(6). <https://doi.org/10.3390/plants12061294>.

Meagher Jr, R.L., Nagoshi, R.N., Fleischer, S.J., Westbrook, J.K., Wright, D.L., Morris, J.B., Brown, J.T., Rowley, A.L. 2022. Areawide management of fall armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae), using selected cover crop plants. *CABI Agriculture and Bioscience (CABI A&B)*. 3:1. <https://doi.org/10.1186/s43170-021-00069-0>.

# Characterization and Evaluation

Cason, J., Simpson, C., Burow, M., Tallury, S.P., Pham, H., Ravelombola, S. 2022. Use of wild and exotic germplasm for resistance in peanut. *Journal of Plant Registrations*. p. 1-25. <https://doi.org/10.1002/plr2.20261>.

Nair, R.M., Pujar, M., Cockel, C., Scheldeman, X., Vanderlook, F., Zonneveld, M., Takahashi, Y., Tallury, S.P., Olaniyi, O., Giovannini, P. 2023. Global strategy for the conservation and use of *Vigna*. Global Crop Diversity Trust. Global Crop Diversity Trust. <https://doi.org/10.5281/zenodo.7565174>.

Patel, J.D., Wang, M.L., Dang, P.M., Butts, C.L., Lamb, M.C., Chen, C.Y. 2022. Insights into the genomic architecture of seed and pod quality traits in the U.S. peanut mini-core diversity panel. *Plants*. 11(7):837. <https://doi.org/10.3390/plants11070837>.

Ravelombola, W., Cason, J., Tallury, S.P., Manley, A., Pham, H. 2022. Genome-Wide Association Study and Genomic Selection for Sting Nematode Resistance in Peanut Using the USDA Public Data. *Journal of Crop Improvement*. p.1-18. <https://doi.org/10.1080/15427528.2022.2087127>.

# Tornado Hits Griffin January 2023

