Pyrus CGC Meeting Minutes

Held Monday, April 29, 2024, over zoom, 10am – 12:30pm PDT

Attendees: Jessica Waite, Chris Gottschalk, Richard Bell, Nahla Bassil, Gary Kinard, Gayle Volk, Kate Evans, Lauri Reinhold, Tami Collum, Joseph Postman, Oscar Hurtado, Clebson Goncalves, Dave Weil, Anne Frances, Bob Gix, Rachel Elkins, Amit Dhingra, Dale Goldy

Agenda and Notes:

Curator Report and Discussion (Lauri Reinhold and Nahla Bassil, see attachments)

Curator Report
Lots of progress in the past year.
Walked through staffing changes and some restructuring of duties – filled RL position (Carolyn Scagel), farm manager position as a Cat3 agronomist position – filled by Gabriel Flores, new technician – Andrew Baker, some continuity with students returning for positions, also now have container team caring for container plants and working with all curators. And April working as distribution manager and helping with GRIN updating.
2024 accomplishments – *agronomist position* – helping in many ways, including allowing curator to do more curating; *new equipment* included cabbed orchard tractor, mulcher, equipment trailer, cabbed mower; *pruning* – playing catchup and smaller tractor will help – looking into help from commercial crews; *removal of 76 trees* – mostly consisted of duplicates ID'd from genetic testing (Sara Montanari's work); *irrigation project* – modernization of north farm irrigation, drip laid at Lewis Brown (leased land from OSU), all pears irrigated. Connected 3 wells (will help with having backup), divided into zones, can be remotely controlled, and sand filtration system should help with iron bacteria buildup (will be fully testing through this season!); Also walked through *disease management and mitigation*.
Acquisitions – March 2024 – 36 accessions fully released from APHIS quarantine; April 2024 – ~80 accessions fully released. Discussed a big push unit-wide to look at inventories and make sure they have most up to date and tested accessions – also, not currently receiving any provisionally released material
Distributions – limited distributions this year – also please note the **new requests window is Sept 1 – Nov 30**, for the purpose of the unit being able to organize/prepare distributions efficiently!
Inventory – Lots of reconciling and updating to do – this is also in conjunction with moving plants for updating the screenhouses. Planning to implement fieldbook and QR codes. Discussed transitions to durable aluminum tags screwed into the trees – avoids dangers of hitting metal stakes with maintenance equipment, and is already implemented with many campus trees – in talks with campus about acquiring a tag printer that can be shared between facilities/institutions. Discussed the use of screws and relationship to disease introduction – unlikely, as screws have been used in repository trees previously without issue, and screws will not be transferred between trees.
GRIN – working towards updating and reconciling with inventory, and future addition of more types of data
Research projects – FPPC funded work with Chris Gottschalk and Tami Collum focusing on fruit quality and post-harvest traits; 2nd round of submitting SCRI focused on post-harvest rots in pomes.
Pyrus Vulnerability Statement – has been updated and accepted for publication
Fruit picking day – organized and held a picking day as an outreach event, included indigenous groups, master gardener groups, gleaner groups

Genetic characterization

Have developed agnostic markers for the Pai Li and Potomac sources of fire blight resistance (not yet for Old Home source)
Working with international community, developing KASP assays for cultivar IDs. Trying to get a set that works across different lab, both domestic and abroad.
SSR -based genotyping of ~500 accessions.

Further discussion not mentioned above:

- Whether getting help from campus with fire blight – Ken Johson came out last year to discuss strategies for fertilizer timing and different chemistries of pesticides for control. Continuing to follow this plan this year, but open to insight and would be great to know who else to talk with. Additionally, Gabriel has been attending local talks on these crops and keeping up to date with what is being presented at meetings.
- Discussion of what accessions were in the material fully released this year – some 2 dozen accessions not in the collection that were collected about 20 years ago from Nova Scotia. Included some early fire blight breeding lines, as well as a few things marked as tetraploid (however, tetraploidy possibly lost through clean-up, may have been chimeric?). Interest from multiple folks to see the list of what all was released. The easiest way to do this will likely be to reconcile with the collection, then pull the list from GRIN.
- This brought up discussion of a paper about a collection of 100 apple and 100 pears in Kentville Nova Scotia, from Charlie Embree et al.. Joseph has since sent around the PDF to the CGC email list.

<u>Breeding Program Updates</u>

Scion Breeding Program, USDA ARS Kearneysville, WV (Chris Gottschalk, see attached)

2023 – 14 new populations generated (focus including mapping psylla resistance, variety development, acidity, high phenolics)
2024 – 9 new populations generated (focus including architecture, post-harvest resistances, red peel, red flesh)
Grant received from FPPC to focus on Penicillium expansum and Colletotrichum foiriniae resistance screening
2022 populations (focused on variety development, germplasm enhancement, ripening, red flesh) being planted this year
Talked about potential release US 79439-004 – Winter pear with about 2 months cold storage, semi-dwarf on OHxF87, moderate fire blight resistance, high sugar, moderate acid, melting flesh, talking about trialing with OSU and WSU so far, established virus-free material with APHIS, sill needs full CA storage evaluation.

Discussion:
Amit interested in trialing in Texas
Discussion of 3 parents for red flesh and different varieties of red fleshed pears that folks liked in testing

Rootstock Breeding Program, WSU Wenatchee, WA (Kate Evans)

Breeding program moving forward – selected about 40 seedlings cut back and propagating – starting to plan trialing at least in WA and OR

Fire blight screening publish – included npgr accessions
Published dwarfing loci – moving forward working with Jessica about what these loci are, using sequencing techniques and services through Hudson Alpha

Update from Amit about aneuploid population and diverse germplasm set –
Working with 36 aneuploid accessions, doing long-read sequencing, methylation, identification of duplication and deletions in the genome.
Working with extension colleagues to start grafting. Coordinated research with atomic agency, focusing on horticultural species.
Sequencing diverse germplasm set as well – new budwood from repository has been grafted onto rootstock material to not lose it – working up to full set.

Discussion:
Question about the Cydomalus hybrid rootstock used in eastern Europe – not being used in the pear rootstock breeding program.

Office of National Programs, GRIN-U, NLGRP reports (Gayle Volk, see attachment)

ONP report
New plant hardiness zone map was released in Nov 2023 (showed NPGS locations mapped onto it).
Decrease in distributions mostly due to filtering out home gardener requests.
NPGS budget is flat when adjusted for inflation, and increases have been very targeted to specific crops.
A few new hires, and still lots of open positions. Job announcement for Peter Bretting's position closed last Friday! (note that this NPL position is too big for one person, and agency is responding to this)
Went over newly released strategic plan highlights (link in attached slides) and key NPGS challenges.

GRIN-U report
Lots of info available at GRIN-U.org! And subscribe if interested!
Useful tools include: printable one pager infographics, YouTube channel with explainer videos (channel name: GRIN-U Education)
Please submit PGR Success Stories (template is attached) – this is particularly important for stakeholders to know how the NPGS helps them.

NLGRP report
For pears, there are 330 accession (good news! Many collections have a lot less)
Maria Jenderek continuing preserving pears
May preserve some Kearneysville material from the breeding program

Discussion:
Well wished to Peter Bretting from the Pyrus CGC

APHIS Report (Oscar Hurtado-Gonzalez)

Beltsville location – goal to protect US agriculture against pathogens
Personnel structure - Each group (Pomes, Prunus and ornamental, veg, poaceae) has a horticulturist, a gardener, and intern, and a PI

Typical quarantine structure: Greenhouse, PCR, and HTS testing of all germplasm, then therapeutics, then retesting, until realease
Pears are a 2 year quarantine process typically
Walked through new pipeline, using a lot more HTS and metagenomics and bioinformatics for identification - removes field indexing for 3 years, because hts and rtpcr is good at identifying pathogens.
Dormant period is important for catching viruses.
2023 – 34 pear accessions final released – much of this is backlog from past collections
Developed a quick method for diagnostics – amplicon-based seq approach that targets all knows viruses/viroids – so can do 100's of samples at once, much faster than individual rtpcr - Just published 2nd version of it

Discussion:
Discussion about integrating true-to-type testing/genotyping. They use KASP markers for apples, but haven't for pears previously. Nahla and Oscar to discuss developing KASP assays for pear that can be used for this purpose.
Question about pear yellow vein situation – for Gem at least, you can now order clean Gen from Prosser.
Question about seed transmitted viruses – mentioned there is a study coming up looking at this.

NRGL Report (Gary Kinard, see attached report)

Highlights vacancies – 3 of these are in NGRL and 2 on the GRIN teams, so working a bit in maintenance mode. One position very recently hired and starting soon.
GRIN-U – echoed Gayle's comments and added if you subscribe that you won't get bombarded with emails
GRIN enhancements and changes – new taxonomy, more options for images of plant parts, also noted that if you submit a request, you'll get an automated message back with instructions on how long it will take (i.e. not helpful to email back right away to ask how long things will take).

Other short updates (Jessica Waite)

Pyrus Crop Vulnerability Statement
Thanks to Joseph Postman, Rachel Elkins, Richard Bell, Lauri Reinhold, Nahla Bassil, Chris Gottschalk, and Gayle Volk for all their help in updating the statement! This was submitted as a manuscript to Genetic Resources and Crop Evolution, and accepted recently! Jessica will send out the link once it is available.

Evaluation and Exploration proposals
Reminder to get Evaluation proposals back to the CGC by May 3rd, and Exploration proposals by July 1, so that they can be reviewed in time.

Discussion:
Talked about ways to distribute to a wider audience than just the CGC (for example, make sure they go to Mt Vernon group). This year these did go out to CGC members, advisory group, as well as a list of folks who have previously expressed interest in attending CGC meetings (and have attended), but did not want to be advisory or voting members.
Reminder about these proposals being designed to evaluate the collection germplasm and ultimately help the collection and Lauri.





Pyrus Crop Germplasm Committee Meeting

April 29, 2024

Lauri A. Reinhold, PhD (she/her)

Horticulturist

Temperate Fruit, Nut, and Hops Curator

USDA ARS National Clonal Germplasm Repository, Corvallis, OR

Staffing Updates

Dr. Carolyn Scagel
Research Leader

Dr. Lauri Reinhold
Pear Curator

Jane Olson
Curator Assistant

Brendan Rojas
Curator Assistant

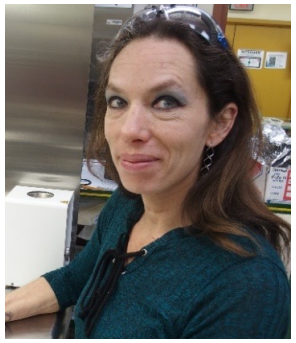
Field Team

Gabriel Flores
Agronomist
(Field Operations Manager)

Andrew Baker
Biological Science Tech

Students: El Huxtable, Faith Townsend, Ben Dirren, Meaghan Herlihy

Container Team



Sunny Green
Container Operations Manager

Chuck Murarz
Biological Science Aid

Student: Deven Pruitt

Field Efforts

- 2023 Challenges
  - No Farm Manager
  - Lack of continuity
  - Accidents/gaps in safety programs
  - Not enough labor

- 2024 Accomplishments!
  - Agronomist position
    - Organization/oversight of all field activities
    - Coordination with curators
    - Implementation of safety program
    - Training: Orchard Management course at UC Davis, local research and extension talks
  - Continuity of student help for 1+ years
  - New equipment

Field Efforts (continued)

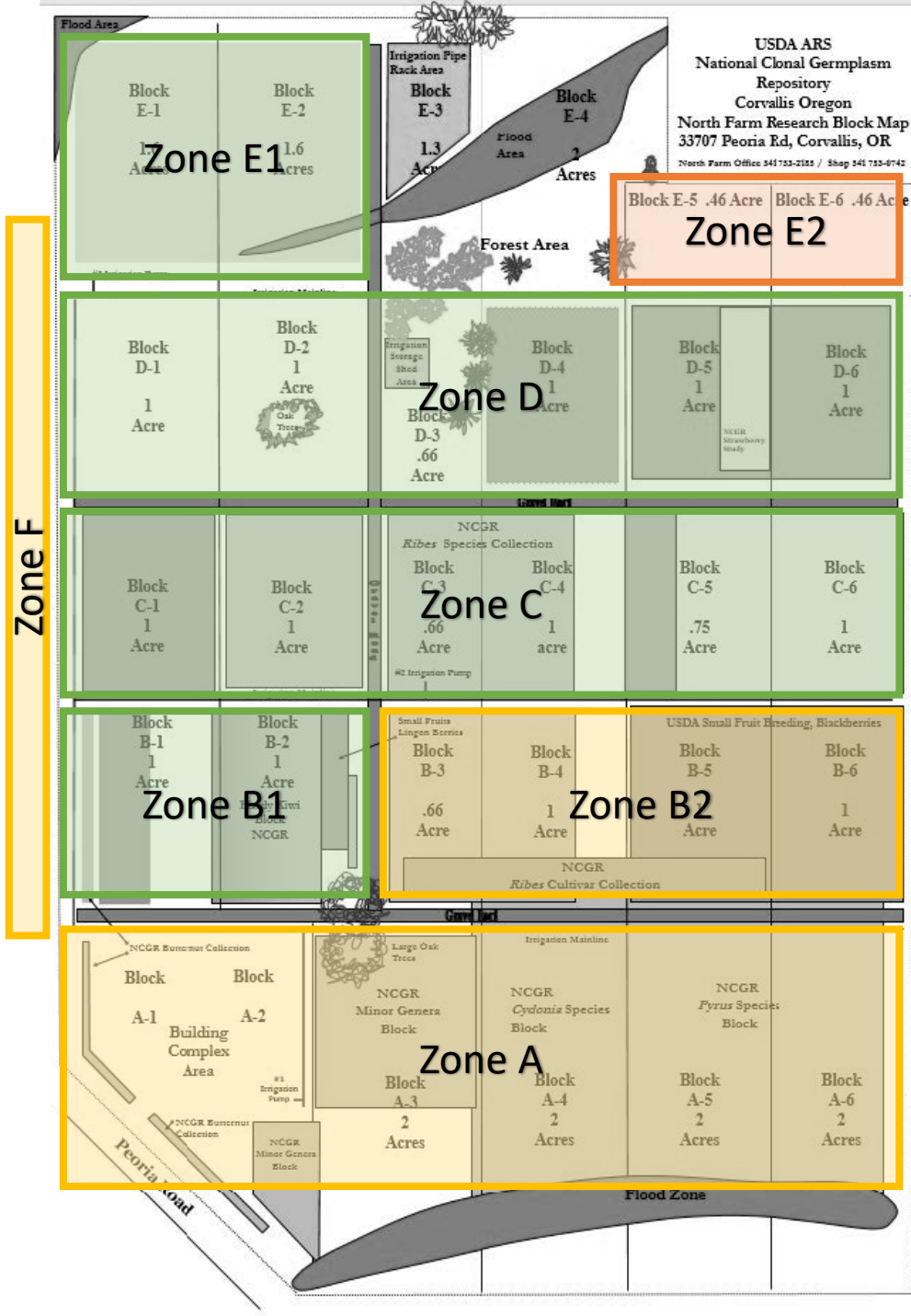
- Pruning
  - Playing catch up
  - Tractor pruning (smaller tractor!)
  - Shaping/thinning – Chipping away, commercial pruning?
- Tree removal
  - 76 trees cut down!
- Irrigation
  - $120k Irrigation modernization at NF complete!
  - Drip irrigation laid for all pears at LB
  - All pears and wild relatives are now fully irrigated

NF Irrigation Project

- Connected 3 existing wells
- Divided into zones
- Single filtration system
- Remotely controlled/programmable

Before

After



Disease Issues/Mitigation

- Fire blight
  - Decision Aid System subscription
  - Management
    - 2024: Kocide, Kasumin/Agrimycin, Blossom Protect
  - Continue to track/monitor/remove fire blight
- Codling moth treatment – no further action
- Virus/viroid testing with Oscar Hurtado-Gonzales (~200 cultivars tested) – no further action
- What other diseases are we missing? – no further action
  - Make plans for scouting and screening for disease presence and disease resistance

2024 Acquisitions

- March 2024 – 36 accessions from APHIS Quarantine Program (fully released)

- April 2024 – ~80 accessions from APHIS Quarantine Program (fully released)

Distribution/Backup

- Limited distribution this year (but accepted orders!)

Genus	Form Available	Requests Accepted	Approximate Shipping
Corylus, Juglans, Mespilus, Pyrus. Sorbus	Scionwood	Sept. 1 - Nov. 30	January - February

- NLGRP, Fort Collins, CO
  - Backup:
    - 20 accessions *P. communis*
  - Experimentation:
    - *2 Cydonia*

Inventory

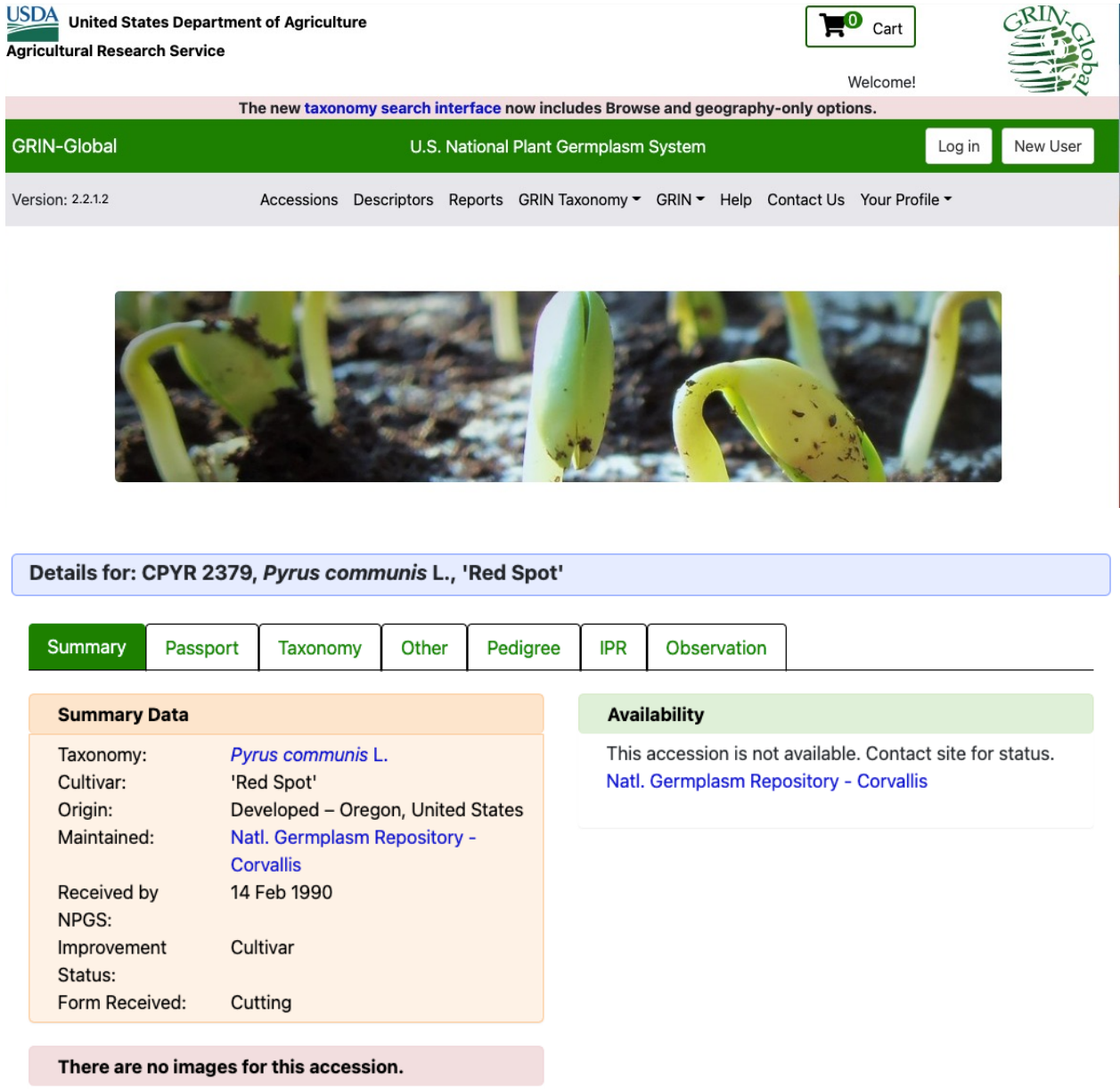
- Next 1-2 years (In-progress!):
  - Reconciling inventories and locations of plants in field and houses
  - Update/ replace labels
    - Damaged, missing labels
    - Incorrect labels with true to type data
  - Screenhouse renovations: Staring in May 2023

- Future (In-progress!) :
  - Removing duplicates
  - Adding QR or barcodes for all
  - Implementing Fieldbook App
  - Transitioning to more durable field label – ideally aluminum engraved

Data in GRIN-Global

- Next 1-2 years (In-progress!):
  - Update information on database
  - Reconcile with inventory

- Long term:
  - Add more phenotypic and genotypic data
  - Add more images
  - Add more passport information



Collaborative Research Projects

- Fresh & Processed Pear Committee Research project (continued funding):
  - "Germplasm evaluation for fruit quality and post-harvest traits" Chris Gottschalk, Tami Collum

FRESH & PROCESSED PEAR COMMITTEE RESEARCH

- SCRI proposal round #2:
  - "Integrating multidisciplinary and translational approaches to manage postharvest rots on apples and pears in major U.S. pome fruit growing regions" Achala KC, et al.

Pear Vulnerability Statement

- Accepted for publication in *Genetic Resources and Crop Evolution* 4/13/24!
- Thank you, Jessica Waite!
- Thank you, authors! Chris Gottschalk, Nahla Bassil, Richard Bell, Joseph Postman, and Rachel Elkins

Fruit Picking Day - October 2024

NCGR Spring 2023

Genetics Lab at the NCGR

Lab Group:

Nahla Bassil

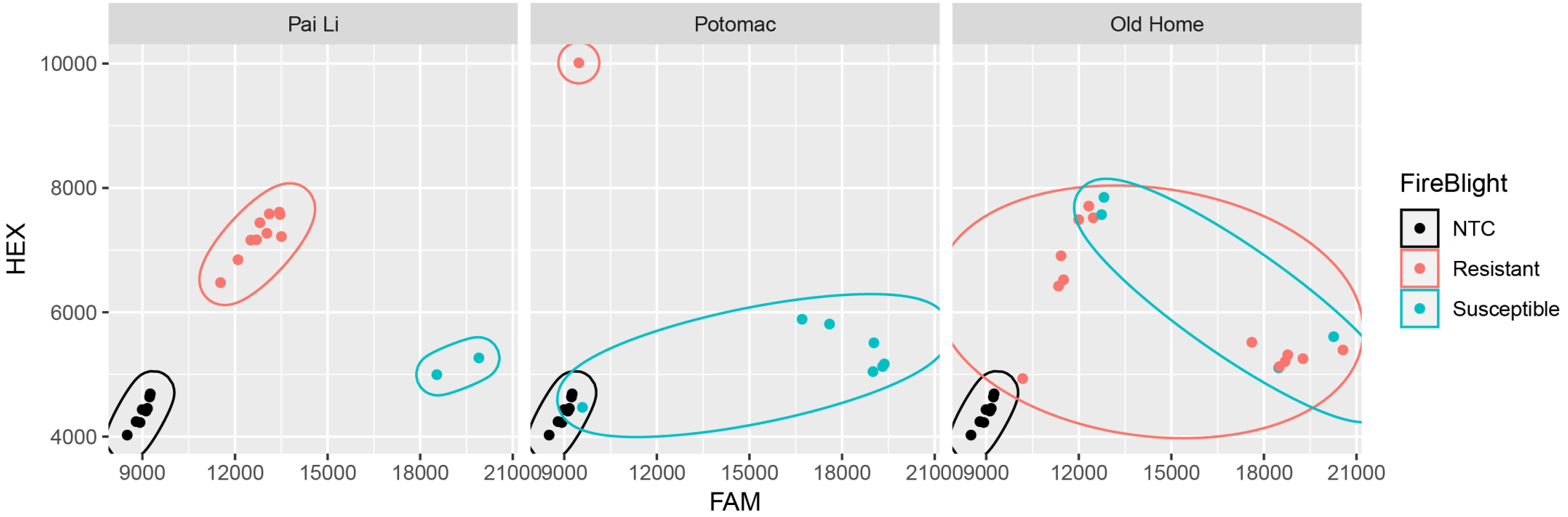
Ryan King

Shaun Clare

Jason Zurn

Shaun Clare and Jason Zurn have moved to other positions WSU and KSU, respectively) and are working with us on writing the fire blight marker publication

A PACE Marker for Fireblight R (Pai Li/Potomac Sources)



Zurn and Clare et al., 2024

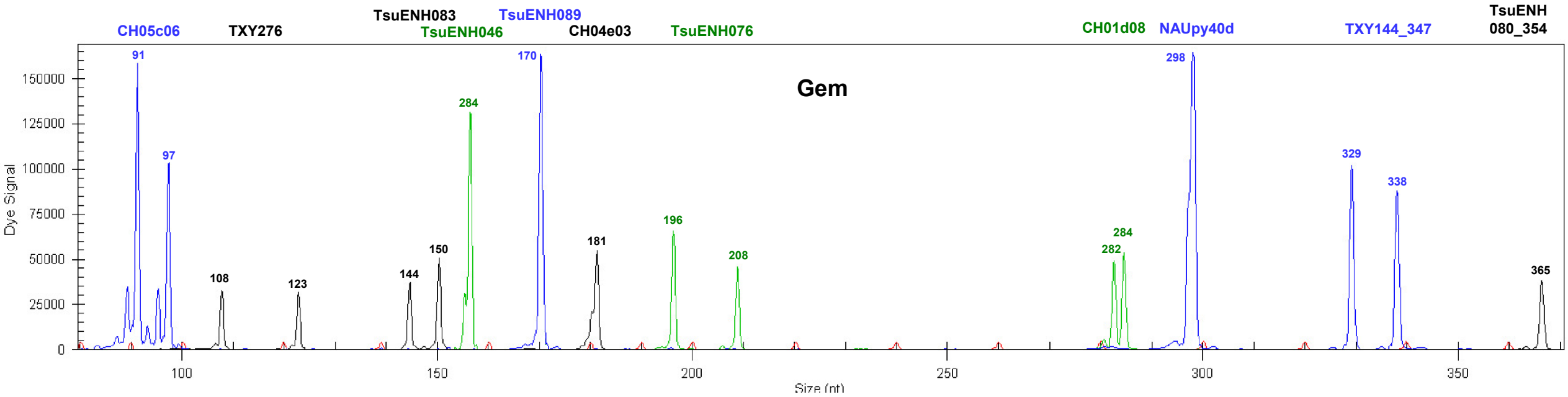
A KASP Assay for Cultivar Identification (Collaboration with Marijn Rymenants,..)

Comparison of 47 Loci across 70K Array, LGC and VHL companies in 384 samples

- Two loci did not work at VHL
- 45 loci worked well in both
- Only two SNPs had lower call rates using KASP probes compared to the 70K array
- Average call rate of KASP assays was ~98%
- Finalizing SNPs in KASP Panel

SNP names	70K	USDA -LGC	VHL-B3F	Average
SNP 1	0,9964	0,8609	0,7940	0,8838
SNP 2	0,9921	0,8817	0,8835	0,9191
SNP 3	0,9885	0,8580	0,9957	0,9474
SNP 4	0,9982	0,8580	0,9957	0,9506
SNP 5	0,9861	0,9852	0,8977	0,9563
SNP 6	0,9909	0,9349	0,9659	0,9639
SNP 7	0,9836	0,9645	0,9631	0,9704
SNP 8	0,9976	0,9379	0,9844	0,9733
SNP 9	0,9891	0,9527	0,9801	0,9740
SNP 10	0,9879	0,9822	0,9616	0,9773
SNP 11	0,9933	0,9645	0,9858	0,9812
.....				

SSR-Based Genotyping



- 10-SSR USPGR Fingerprinting Set continues to be used to identify unknown trees and duplicates,…mis-identified trees by comparison to > 500 unique pear genotypes from the NCGR collection: For example, ‘Reimer’s Hybrid’ had the same genotype as ‘Shroyer’s Sunset.

AFRS PEAR BREEDING PROGRAM UPDATE

NEW POPULATIONS

2023 – 14 new populations generated

- Variety development
- Mapping psylla resistance
- Two distinct mapping populations for acidity
- Couple of populations for high phenolics/perry

2024 – 9 new populations generated

- Architecture (columnar/spur-bearing)
- Lots of post-harvest disease resistance mapping populations
- Red peel and red-flesh population

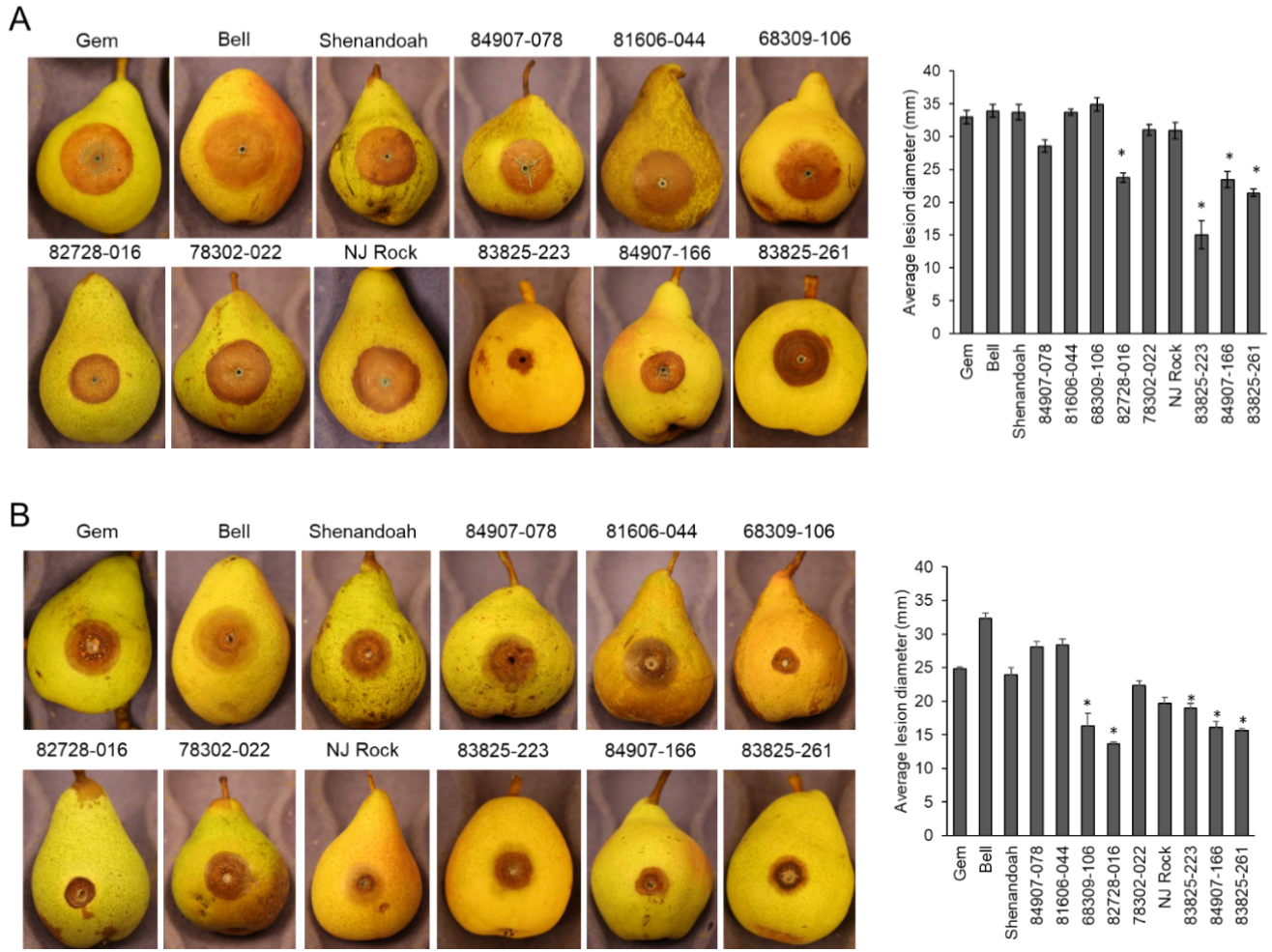


Figure 1. Wound inoculation of pear genotypes with *Penicillium expansum* (A) or *Colletotrichum fioriniae* (B). A representative image of lesion development 7 days post inoculation is shown for selected pear genotypes. Bars represent the mean lesion diameter (mm) ± standard error, N = 20 fruit. A * indicates a significant difference of $p < 0.01$ compared to Gem using a one-way ANOVA with post-hoc Tukey HSD test

From AFRS Tami Collum

2022 POPULATIONS

Being grafted onto OHxF87 and planted in the field this season.

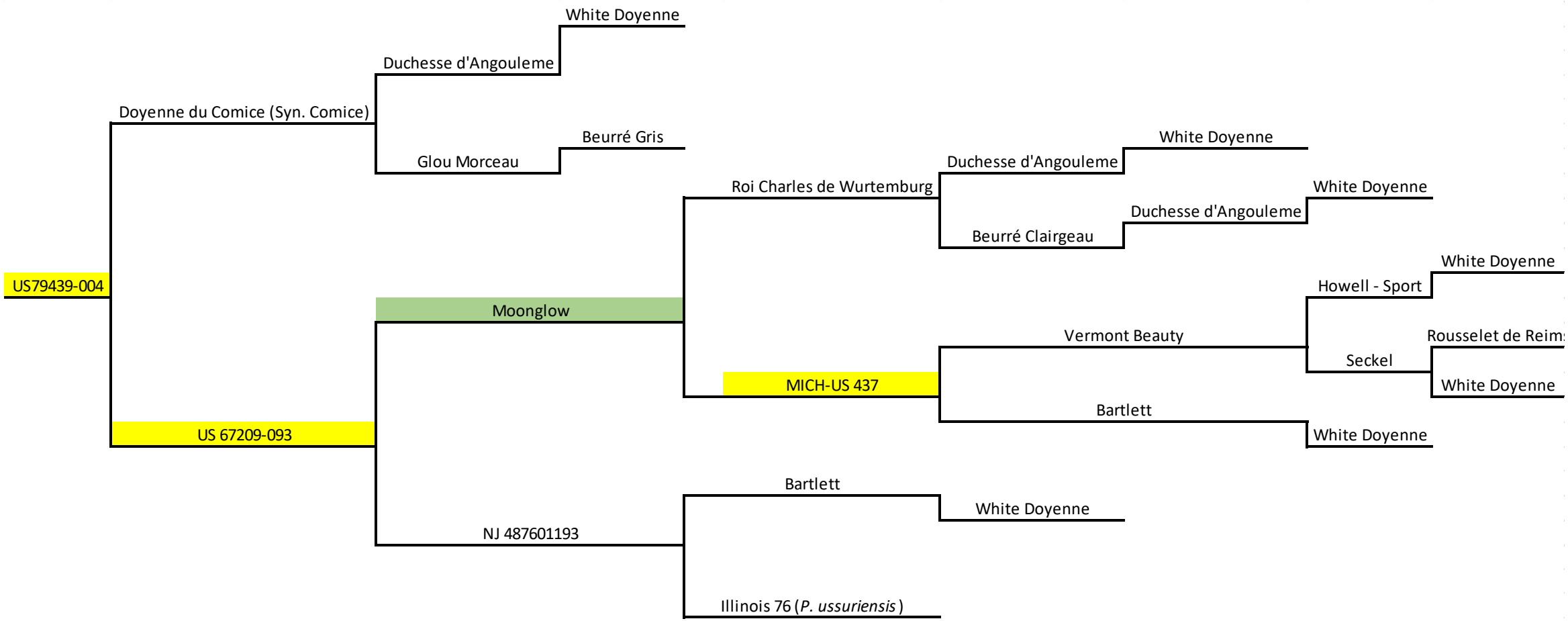
Lots of variety development populations, germplasm enhancement populations, mapping populations for chilling independent ripening and red-flesh

US 79439-004 PROSPECTIVE RELEASE

- **Compete with Anjou**, winter pear harvested in mid/late September and requires 2+ months of conditioning
- **Semi-dwarf, spur-bearing, upright tree on OHxF87**
- **Moderate fire blight resistance (='Shenandoah'), we believe it has Psylla resistance/tolerance**
- **High sugar (14° brix), moderate acidity (3.4% TA), low phenolics (2.35% TPC), buttery/melting flesh, and Comice-like flavor**
- **PEMTRA in process with OSU and WSU for trialing**
  - Stefano Musacchi
  - Ashley Thompson
  - Additional sites next year (MSU, PSU, any one else?)
- **In discussion with OTT on the approach for release (i.e. patenting vs open)**
- **Established virus-free material with APHIS, any propagation material will come from those clones**
- **<u>Need CA storage evaluations</u>**

US 79439-004 PROSPECTIVE RELEASE

“It was juicy, sweet, and had some tropical fruit/citrus notes to the flavor that was very pleasant and unique. I think virtually everyone agreed that it ate far better [than] any of the fruit we had sampled…”
– Tory Schmidt, WTFRC



Complete pedigree of US 79439-004 based on historical notes and Montanari et al., 2020.

The National Plant Germplasm System: 2024 Status, Prospects, and Challenges

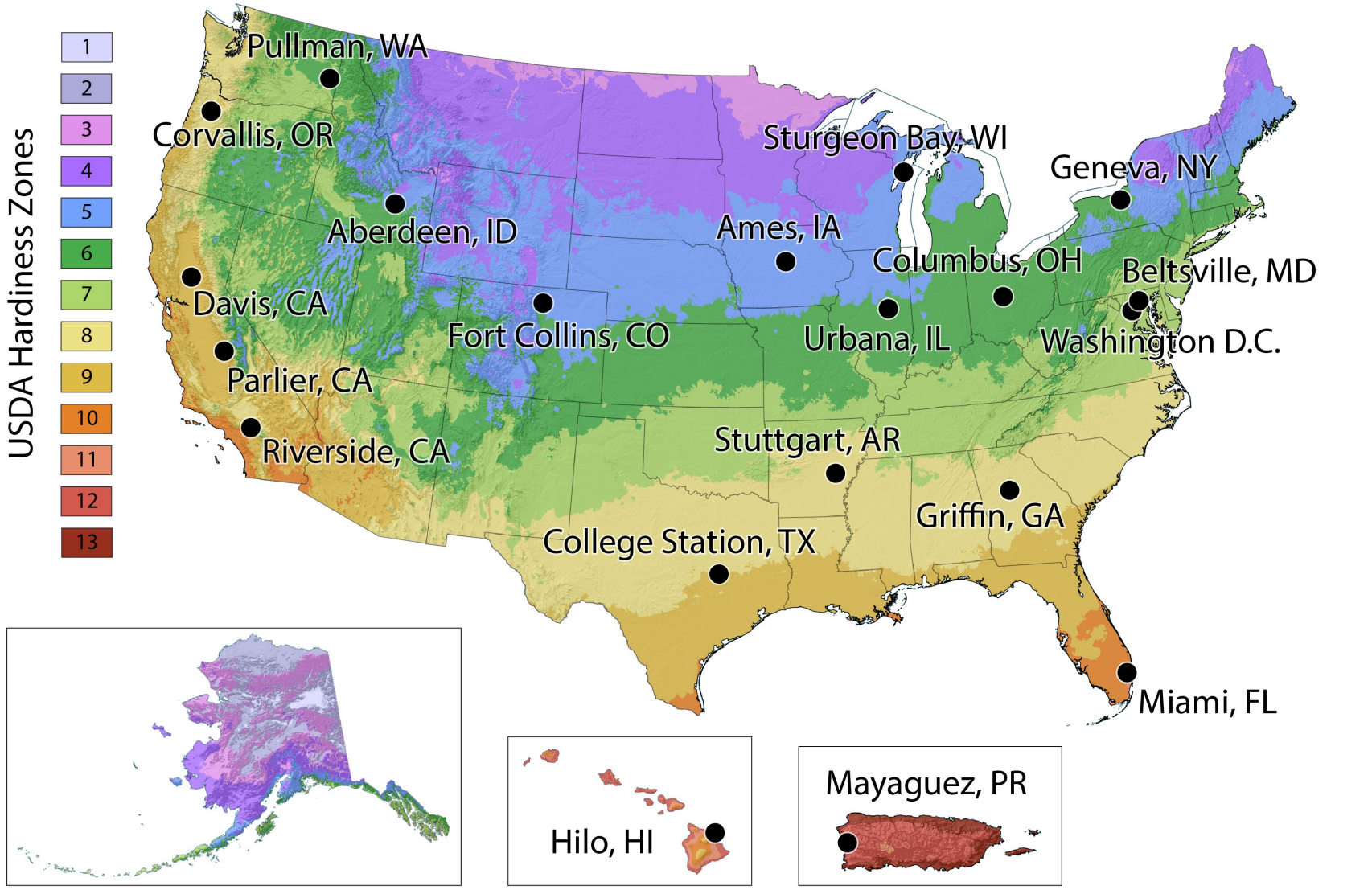
Gayle Volk, Ph.D.

Office of National Programs (detail)

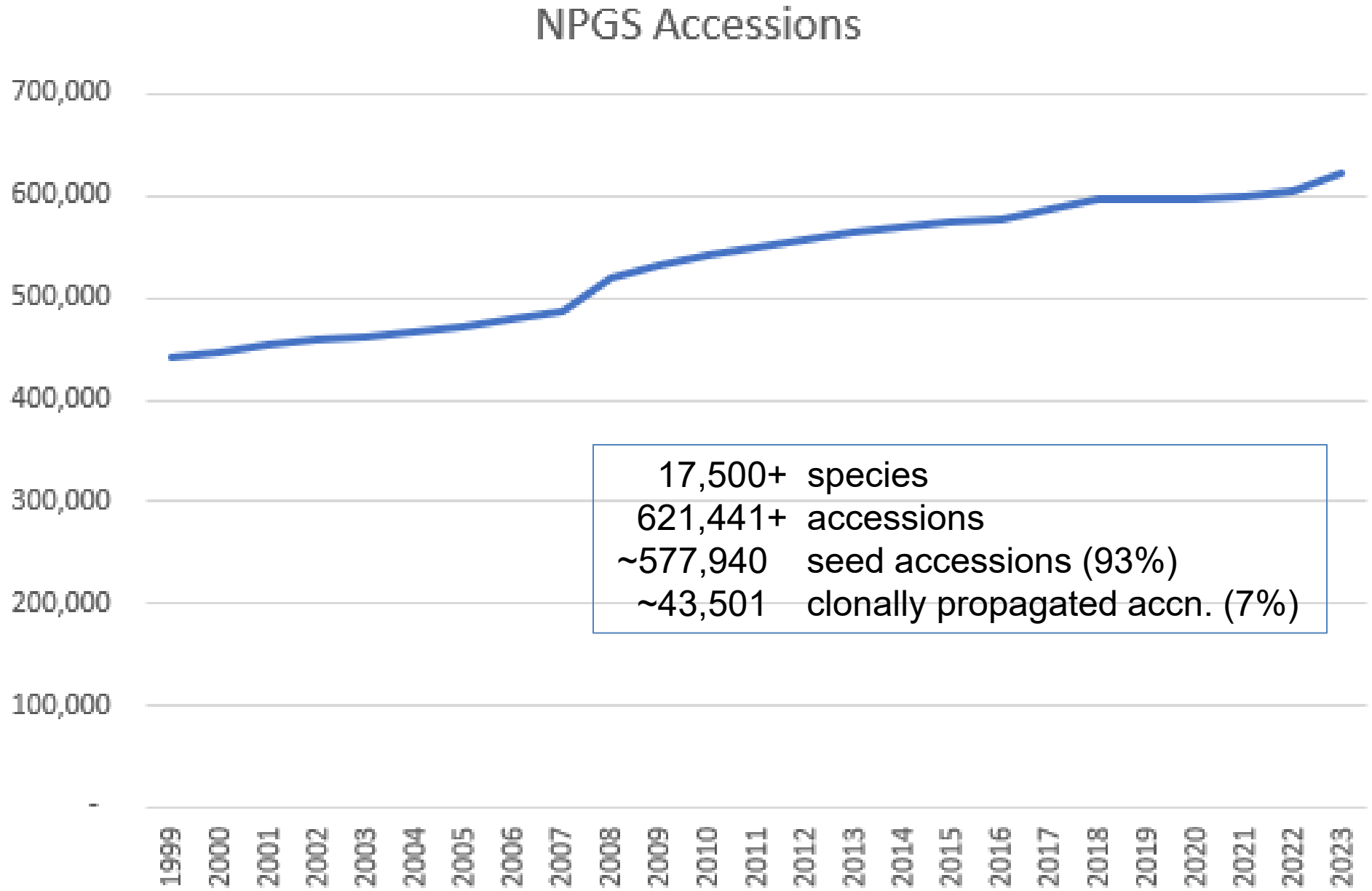
National Laboratory for Genetic Resources Preservation, Fort Collins, Colorado

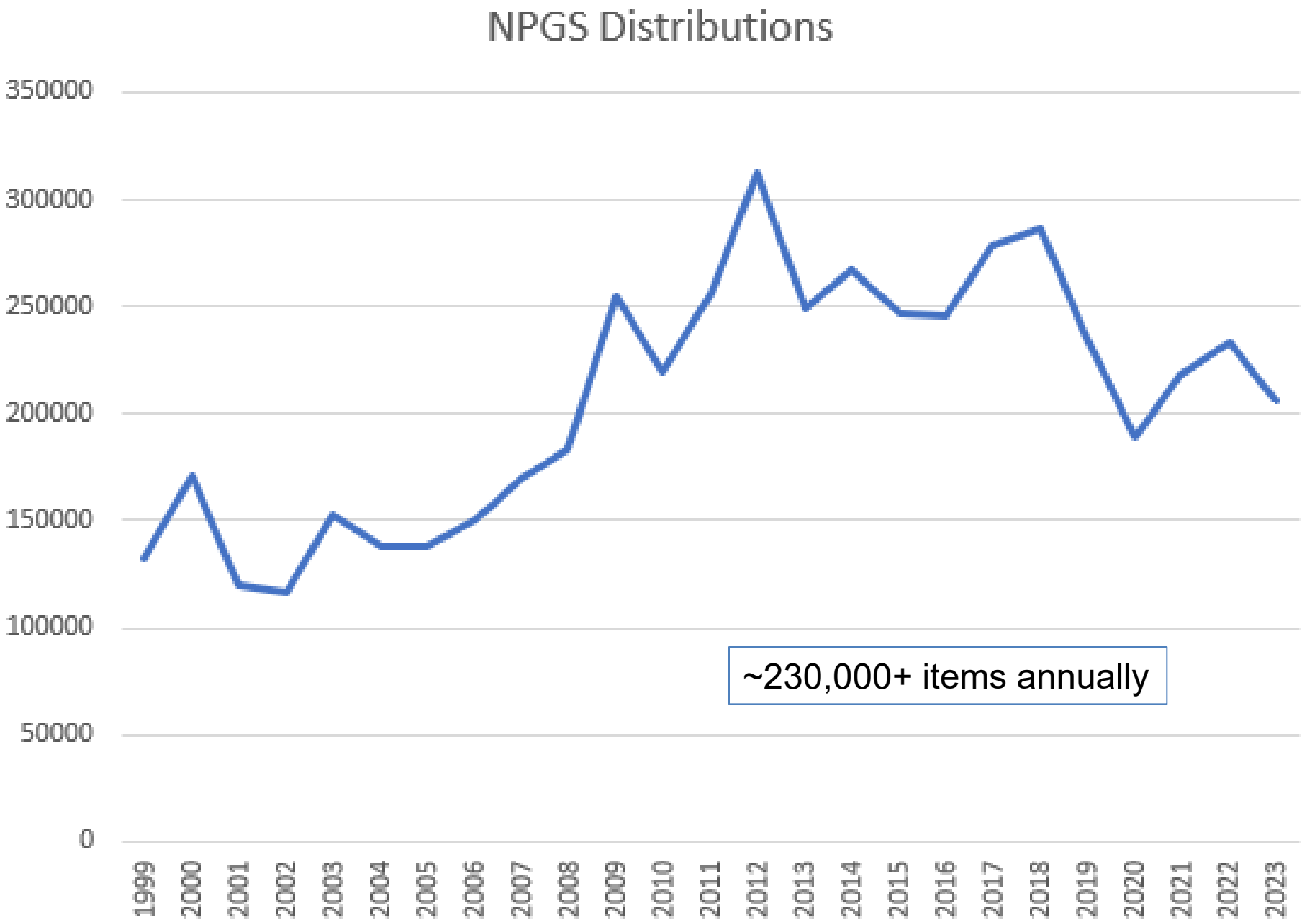
Gayle.Volk@usda.gov

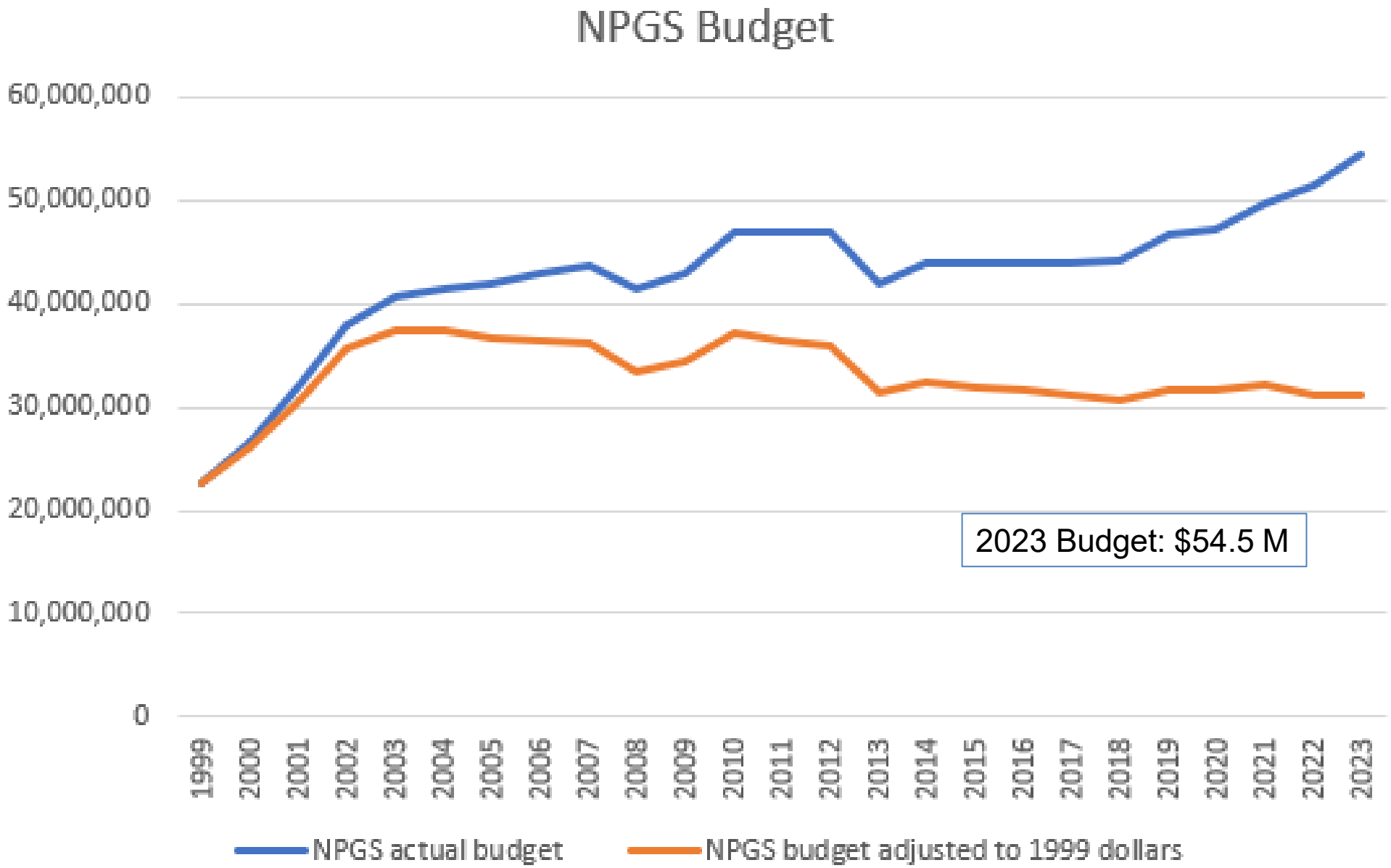
USDA National Plant Germplasm System (NPGS)



New Plant Hardiness Zone Map released 11/2023


NPGS Accessions
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
17,500+ species
621,441+ accessions
~577,940 seed accessions (93%)
~43,501 clonally propagated accn. (7%)


NPGS Distributions
350000
300000
250000
200000
150000
100000
50000
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
~230,000+ items annually


NPGS Budget
60,000,000
50,000,000
40,000,000
30,000,000
20,000,000
10,000,000
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2023 Budget: $54.5 M
NPGS actual budget
NPGS budget adjusted to 1999 dollars

FY 23 ARS NPGS Budgetary Increases

- National Arboretum (ca. $138,000) Washington, D.C.
- Sugarcane Variety Development (ca. $166,667) Miami, FL
- Small Fruits PGR (ca. $500,000) Corvallis, OR
- Pecan Genetic Research (ca. $500,000) College Station, TX

NPGS Personnel Transitions

- Farewell and best wishes to Peter Bretting (NPL), Tomas Ayala-Silva (Mayaguez), Harold Bockelman (Aberdeen), Kevin Conrad (National Arboretum), Kurt Endress & Matthew Riggs (DBMU), Barbara Hellier (Pullman), David Peters (Ames)

- Welcome to Noelle Anglin (Aberdeen), Alex Cornwall (Pullman), Yu Ma (Ohio State), Rebecca Povilus (Geneva); Carolyn Scagel (Corvallis), Singh Sukhwinder (Miami)

NPGS Strategic Plan

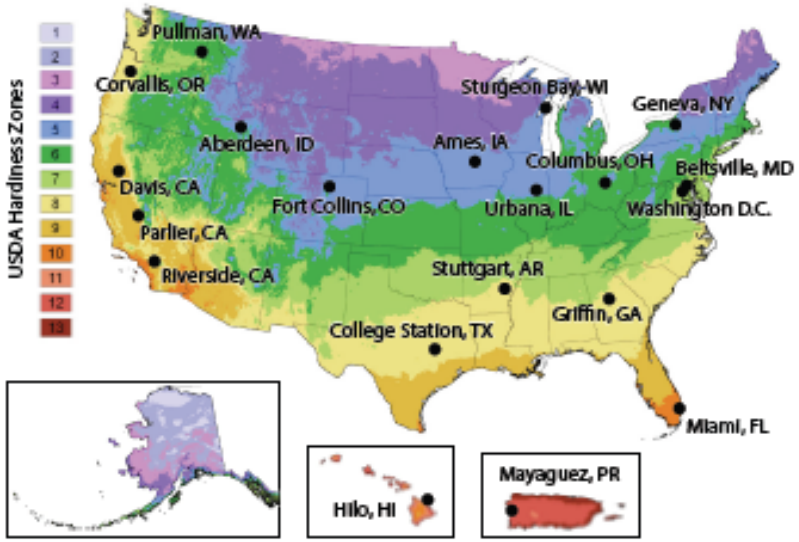
2018 Farm Bill directed USDA to develop and implement an assessment to address the significant backlogs in the NPGS. The NPGS Plan was released in 2023 and is available at https://www.ars-grin.gov/Pages/NPGS

- NPGS Plan Infographic
- NPGS Plan Synopsis of the National Strategic Germplasm and Cultivar Collection Assessment and Utilization Plan
- NPGS Plan Technical Details, Analyses, and Approaches
- Crop and Crop Wild Relative Collections Data

NPGS Plan Infographic (front)

Strengthening the USDA/ARS National Plant Germplasm System to Conserve and Utilize Crop Germplasm That Sustains Us

The U.S. National Plant Germplasm System (NPGS) is Crucial to Global Food Security



NPGS safeguards and delivers plant germplasm for food, fiber, animal feed, industrial, medicinal, and ornamental crops. Plant breeders utilize that plant germplasm to develop new crop varieties that are more nutritious, with higher yields, resilience to extreme weather, and resistance to diseases and pests.

NPGS has **22** genebanks that...

- manage **200+** crops
- maintain **600,000+** unique kinds of plant germplasm
- distribute **200,000+** research samples each year

The NPGS Faces Daunting Challenges

Inadequate NPGS genebank operational capacity results in losses and deteriorating germplasm quality.

NPGS collections have critical backlogs in:

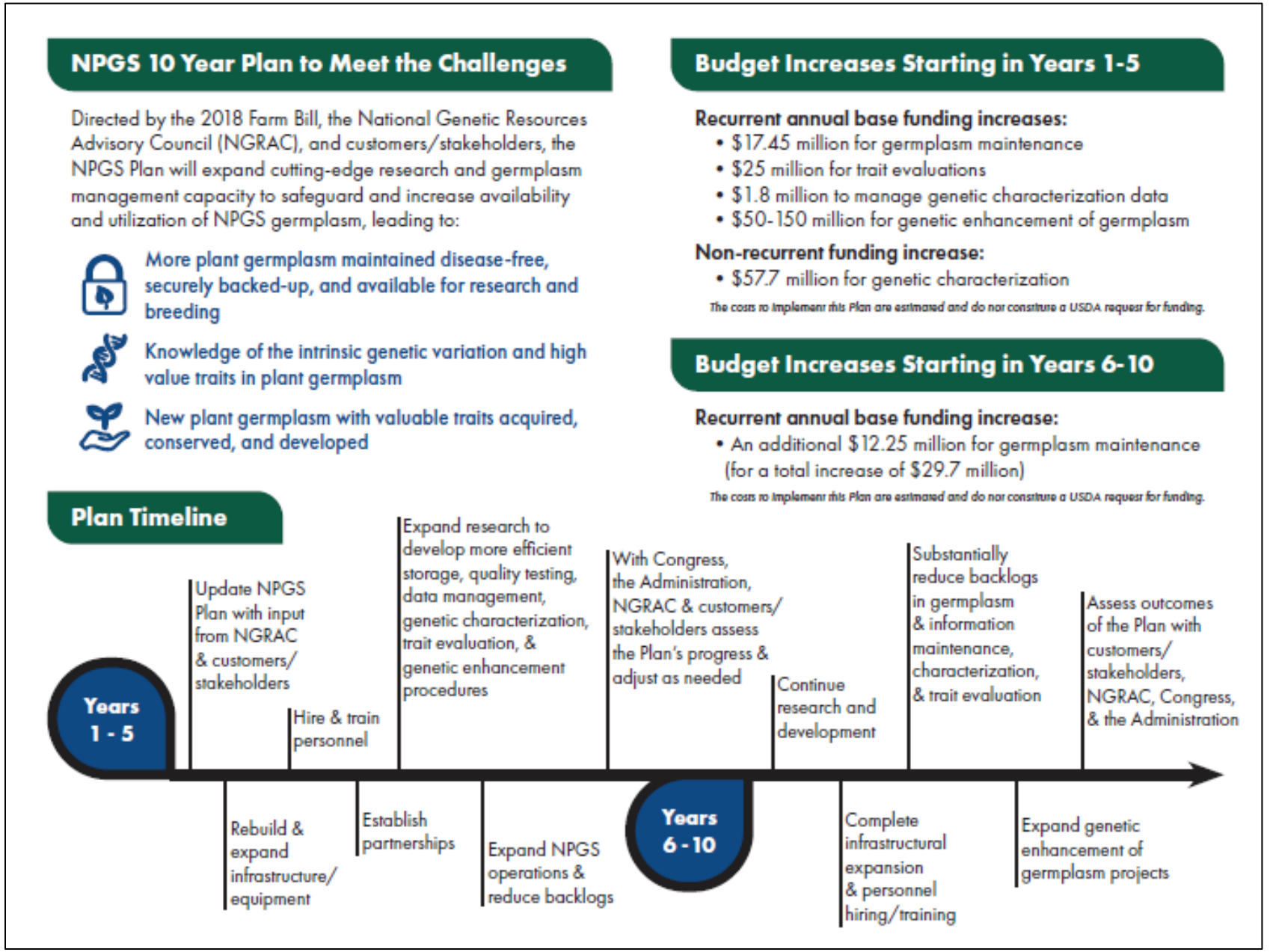
- securing plant germplasm in long-term storage
- testing plant germplasm quality and health
- regenerating plant germplasm
- characterization, trait evaluations, and genetic enhancement of germplasm

Lack of technical knowledge for conserving some plant germplasm, particularly wild species, limits the scope of germplasm the NPGS can effectively safeguard.

Contact: Peter.Bretting@usda.gov
Designed by: Katheryn Chen & Gayle Volk

USDA

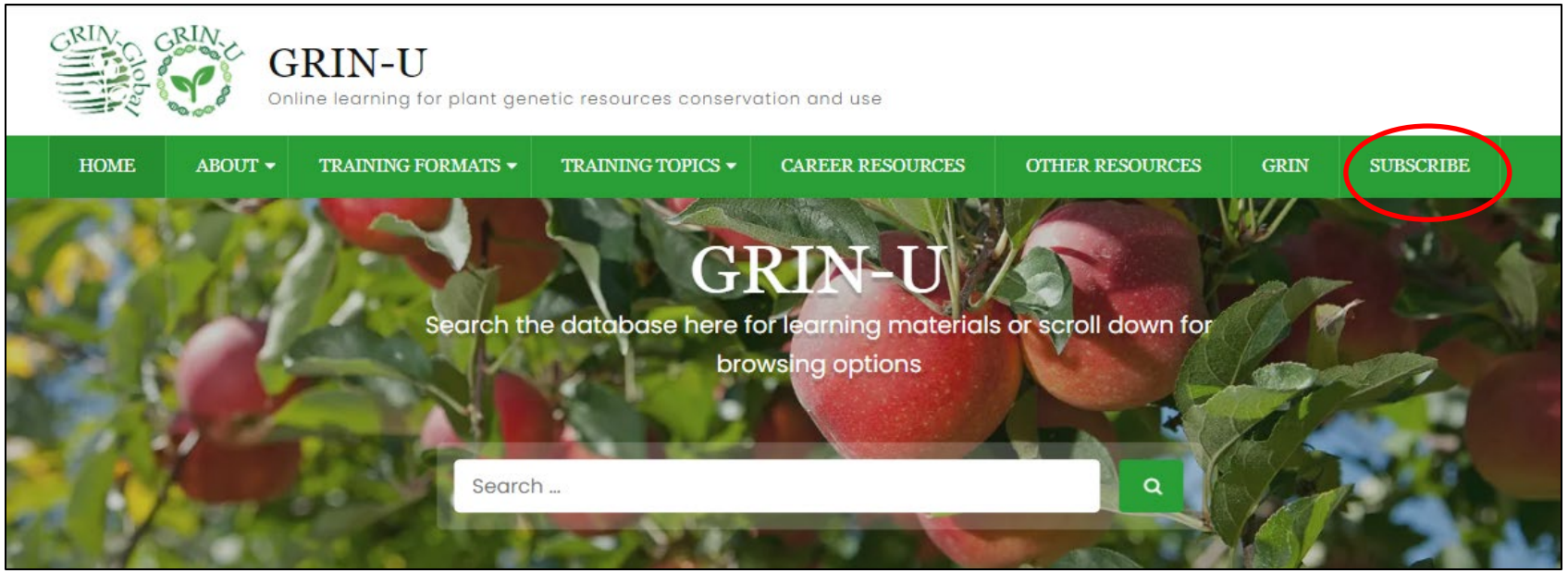
NPGS Plan Infographic (back)



Some key challenges for the NPGS

- Increased operational costs (labor, inputs, overall inflation).
- NPGS personnel transitions—hiring, training, etc.
- Backlogs for regenerations and viability testing.
- Developing and applying cryopreservation and/or in vitro conservation methods for clonal and some seed PGR.
- BMPs and procedures for managing accessions with GE traits in more crops, the occurrence of adventitious presence (AP), and the products of gene editing.
- Acquiring and conserving additional PGR, especially of crop wild relatives.

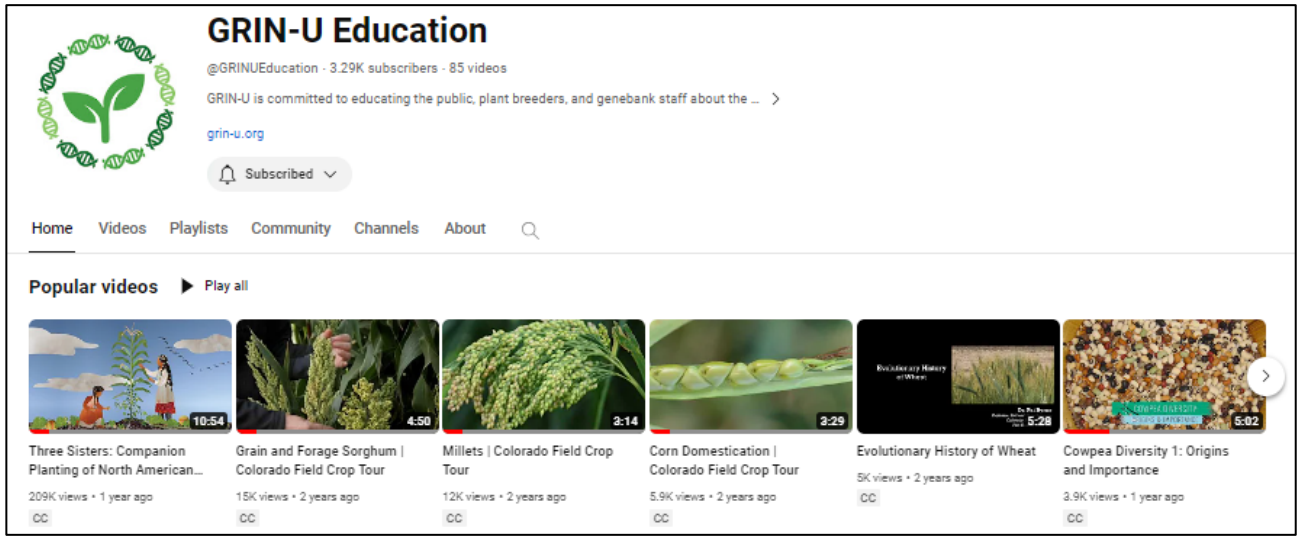
Educational Resources for PGR Conservation and Use



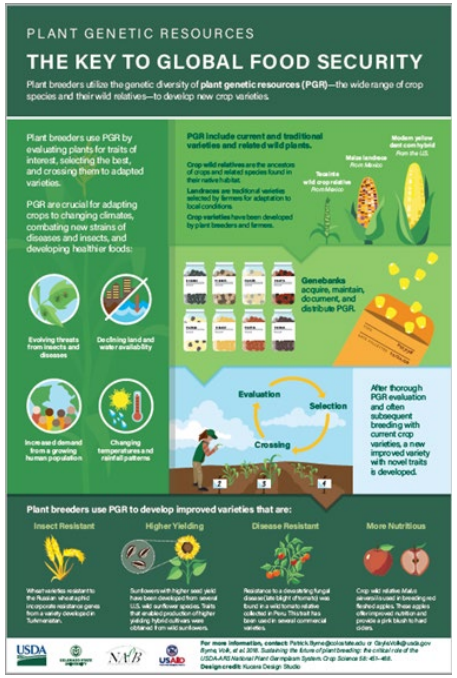
GRIN-U.org

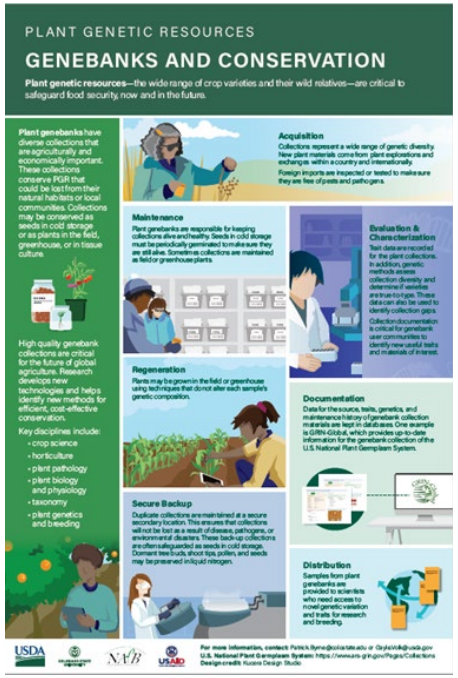
eBooks
Videos
Infographics
Webinars
Links to other resources

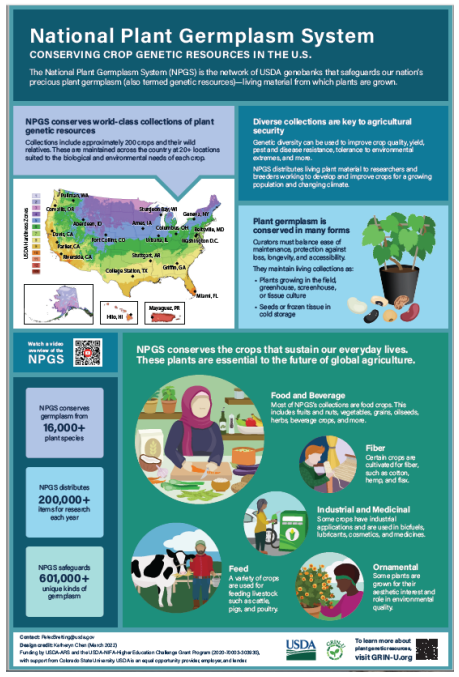
GRIN-U Education YouTube



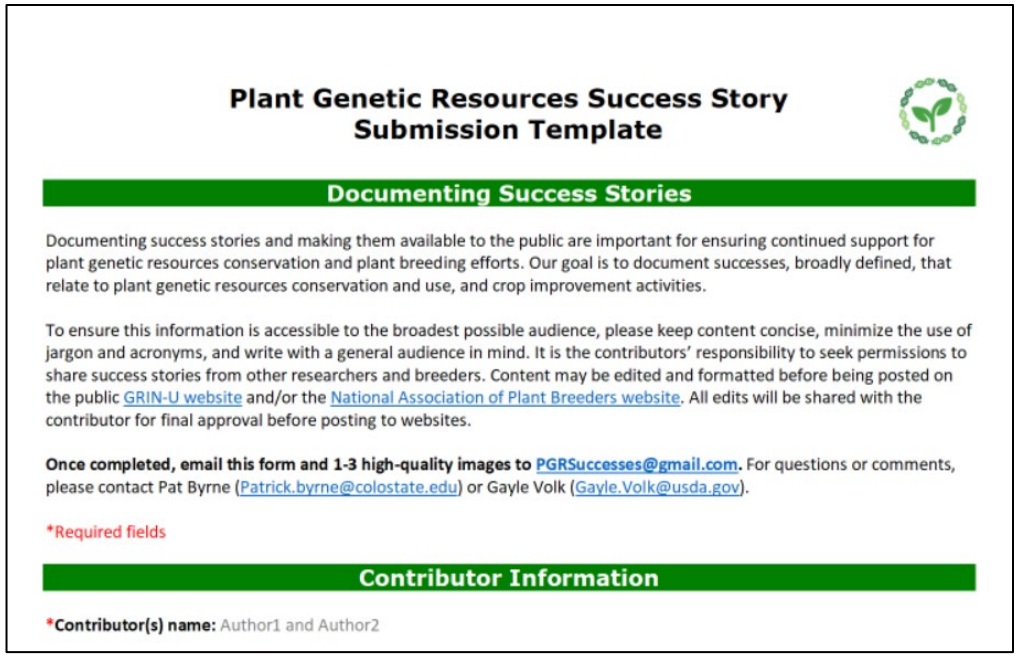
Infographics







Submit PGR Success Stories!



Plant Genetic Resources Success Story Submission Template

Documenting Success Stories

Documenting success stories and making them available to the public are important for ensuring continued support for plant genetic resources conservation and plant breeding efforts. Our goal is to document successes, broadly defined, that relate to plant genetic resources conservation and use, and crop improvement activities.

To ensure this information is accessible to the broadest possible audience, please keep content concise, minimize the use of jargon and acronyms, and write with a general audience in mind. It is the contributors' responsibility to seek permissions to share success stories from other researchers and breeders. Content may be edited and formatted before being posted on the public GRIN-U website and/or the National Association of Plant Breeders website. All edits will be shared with the contributor for final approval before posting to websites.

Once completed, email this form and 1-3 high-quality images to PGRSuccesses@gmail.com. For questions or comments, please contact Pat Byrne (Patrick.byrne@colostate.edu) or Gayle Volk (Gayle.Volk@usda.gov).

*Required fields

Contributor Information

***Contributor(s) name:** Author1 and Author2

National Laboratory for Genetic Resources Preservation
Fort Collins, CO

Daren Harmel: Research Leader

Christina Walters: Seed Research & Viability, Lead Scientist
Vacant, Seed Curation & Microbes
Chris Richards: Population Genetics
Maria Jenderek: Clonal Curation
Gayle Volk: Clonal Research & Implementation, GRIN-U Training

Harvey Blackburn: Animal Geneticist, Lead Scientist
Phil Purdy: Animal Physiologist

NPGS Collections

82% of the NPGS seed accessions are secured (~ 500,000 accn)

15% of the NPGS clonal accessions are secured (~5000 accn)

-18°C Freezers
seed storage

LN & LNV (-150 to -196°C)
Clonal shoot tips &
dormant buds, as well as
embryonic axes, some
seeds, and pollen

Thank you!

- Serving as customer and Stakeholder resources for the NPGS
- Submit Success Stories
- Update Crop Vulnerability Statements & Quad Charts
- Work with us to contribute GRIN-U content
- Evaluation and Exploration Proposals

USDA-ARS
National Germplasm Resources Laboratory
Beltsville, Maryland
2024 Report to PGOC, RTACs, and CGCs

The National Germplasm Resources Laboratory (NGRL) supports the acquisition, introduction, documentation, evaluation, and distribution of germplasm by the National Plant Germplasm System (NPGS) and other components of the U.S. National Genetic Resources Program (NGRP). The Laboratory is comprised of the Plant Exchange Office (PEO), the Database Management Unit (DBMU), and the Plant Disease Research Unit (PDRU).

Rachel Patterson joined the pathology project in July 2023 as a Biological Sciences Laboratory Technician. Also in July, Dr. Peter Abrahamian joined NGRL as a Research Plant Pathologist, filling the position vacated by Dr. Dimitre Mollov. Learn more about Rachel and Peter at the NGRL News site. Matthew Riggs resigned as an IT Specialist in the GRIN project in August 2023. In November, Kurt Endress retired after more than 40 years of working on GRIN. Kurt was the last of the original team that initiated the GRIN project in the early 1980s. He will assist the GRIN project as a part-time contractor until the two current GRIN vacancies are filled, one of which should be by spring 2024.

Plant Exchange Office

Plant Exploration and Exchange Program:

The PEO supports the acquisition of germplasm for the NPGS by managing the Plant Exploration and Exchange Program. Proposals received for FY 2024 funding are being reviewed. Guidelines for developing proposals for FY 2025 will be distributed to CGC chairs in February 2024. Proposals must be endorsed by the appropriate CGC or other crop experts to be considered for funding.

- In FY 2023, one international and four domestic explorations were conducted:
  - *Citrus* germplasm (Vietnam)
  - *Grindelia squarrosa* (western U.S.)
  - *Monarda* sp. nov. (KY)
  - *Chionanthus virginicus* (MO, AK)
  - *Phaseolus* spp. (NM)
- Two domestic explorations will begin in spring 2024:
  - *Fraxinus nigra* (northeast U.S.)
  - *Malus coronoria* (MI)
- Explorations postponed from previous years will continue to be rescheduled as feasible.

All foreign explorations supported by the PEO must comply with the principles in the Convention on Biological Diversity covering access and benefit sharing related to genetic resources. Prior informed consent to collect genetic resources is obtained from the host country

before the exploration. The PEO engages in most requests to foreign governments for permission to collect and negotiates the terms of agreements when necessary.

Collaboration on Crop Wild Relatives in the U.S.:

The NGRL has continued its collaboration with NatureServe, the U.S. Botanic Garden, and other partners to conserve *Vitis* species native to North America following a workshop held in November 2022. The collaboration has resulted in a special issue in Plants, People, Planet with an open call for papers. Conservation status assessments for each native *Vitis* species are available on NatureServe Explorer. County level maps are being developed, and a gap analysis is underway. This collaboration will be featured during a symposium at the International Botanical Congress in summer of 2024.

GRIN Taxonomy for Plants:

- GRIN Taxonomy, available through GRIN-Global (https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch), provides online current and accurate scientific names and related taxonomic data for the NPGS and other worldwide users. This standard set of plant names is essential for effective management of ARS plant germplasm collections, which now represent ca. 17,500 taxa. A broad range of economically important plants is supported by GRIN nomenclature, including food, spice, timber, fiber, drug, forage, soil-building or erosion-control, genetic resource, poisonous, weedy, and ornamental plants. Most of the search pages were rewritten in 2021 to allow a broader range of searches and provide the option to export most search results, and the World Economic Plants search was rewritten in 2022.
- GRIN Taxonomy includes scientific names for 28,082 genera (14,720 accepted) and 1,422 infra-genera (1,350 accepted) and 129,188 species or infra-species (70,948 accepted), with over 68,700 common names, geographical distributions for 64,349 taxa, 520,059 literature references, and 34,895 economic importance records. These numbers increase regularly.
- Since 2008, a project to provide thorough coverage of wild relatives of all major and minor crops in GRIN Taxonomy has been underway. We have completed our initial work on 397 major and minor crops from 179 genera, and CWR from 4,395 taxa have been mapped to these crops and others under progress. In addition, multiple crops have been updated to reflect recent publications on CWR genepools and breeding usages. An interface to query these data is available (https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearchcwr.aspx). We invite feedback from NPGS curators and CGC members for those CWR classifications already developed.

Facilitation of Germplasm Exchange:

- The PEO expedites distribution of germplasm from the NPGS to foreign scientists and international genebanks through collaboration with USDA-APHIS at Building 580, BARC-East in Laurel, MD.
- In 2023, 605 public orders containing a total of 45,909 samples of NPGS accessions were shipped from the Beltsville Plant Inspection Station through PEO to individuals in 62

countries. The order backlogs significantly decreased in 2023 and the timeliness of inspecting and shipping international orders continues to improve. PEO also facilitated the agricultural inspection of arriving germplasm shipments containing accessions from foreign countries for researchers and curators at NPGS sites.

Crop Germplasm Committees:

- Many CGCs continue to meet regularly and are active. In-person meetings, often with a remote participation option, are more commonplace now that pandemic travel restrictions have mostly been lifted. All committees are urged to meet at least annually and especially to update their Crop Vulnerability Statements (CVS). Several CGCs recently completed new or updated CVS.
- The 2023 CGC Chairs meeting was held March 1, 2023, and the presentations are archived on the CGC page at https://www.ars-grin.gov/CGC.
- An NGRL Zoom account is available upon request for CGC meetings.
- Please send committee minutes and reports that can be publicly posted on the CGC page of GRIN (https://www.ars-grin.gov/CGC) to Gary Kinard.
- The preferred method of updating committee rosters is Gary Kinard will give the chair or secretary of the CGC edit permission to their roster, which is a Google doc spreadsheet. The updates can be efficiently made in real-time on the GRIN CGC page.

Database Management Unit

GRIN and GRIN-Global:

- At the time of this report, the GRIN-Global plant database included 621,444 active accessions of 2729 genera and 17,529 species of plants important to food and agricultural production. These numbers, which include those from four non-ARS partner collections, increase regularly.
- A notable change in NPGS policy and procedures was implemented on January 1, 2024. All distributions of all ARS collections taxa to locations outside U.S. states and territories are now accompanied by the Standard Material Transfer Agreement (SMTA) of the International Treaty on Plant Genetic Resources for Food and Agriculture. International requestors click-accept the terms of the SMTA as part of the shopping cart process on the public website. Domestic (U.S. states and territories) orders are accompanied by the SMTA only if the NPGS acquired the material with an SMTA.
- Incremental improvements were made to the GRIN-Global public website throughout 2023. Some of the more impactful to users: 1) The capability to search on accession images was added as an advanced search feature. It includes 34 different plant parts that can be queried if an image is tagged with at least one of them. 2) The frequency count of an accession observation was added as the summary display of trait observations. 3) Numerous improvements were made to the germplasm request experience. For example, the system-generated email sent acknowledging a request submission includes a link to FAQ about the subsequent review, approval and shipping processes. Another example is we revised the order-related actions in the profile order history to display only those that are meaningful to the requestor. We also added a field to enter the order number in the

Contact Us form. If this field is entered by the requestor, the email is routed to the site(s) involved in the request. 4) The accession detail page citations (part of the "other" tab) now displays a link to a listing of all accessions that include that citation. 5) Refinements were made to the seasonable availability options for requesting clonal accessions.

- Current information about the GRIN-Global project, including user documentation and release notes from each version of the software, can be found on the project public website at https://www.grin-global.org/.
- The addition of content and features enhancements continues on the GRIN-U educational and training public website. As of this writing, the site includes a total of 235 externally sourced and GRIN-U original content items. A quarterly newsletter is distributed highlighting recent content additions.

Plant Disease Research Unit

The PDRU conducts research on pathogens that infect clonally propagated prohibited genus (i.e., quarantine) crops, including etiology, detection, and elimination by therapeutic procedures. This project provides direct support to the APHIS Plant Germplasm Quarantine Program and helps facilitate the safe introduction, conservation, and international exchange of valuable plant germplasm. PDRU also collaborates extensively on virus related problems with NPGS germplasm repositories, state departments of agriculture, the National Clean Plant Network, and university scientists. Additional updates will be provided for those committees whose clonal crops are within the scope of this project's research.

Key NGRL Contacts

Research Leader
Gary Kinard (gary.kinard@usda.gov)

Plant Exchange Office
Anne Frances (anne.frances@usda.gov)
Jennifer Friedman (jennifer.freidman@usda.gov)
Melanie Schori (melanie.schori@usda.gov)
Karen Williams (karen.williams@usda.gov), contractor

GRIN-Global Data Management and Reporting
Benjamin Haag (benjamin.haag@usda.gov)

GRIN-Global Documentation and Training
Marty Reisinger (marty.reisinger@usda.gov)

Crop Germplasm Committees
Gary Kinard (gary.kinard@usda.gov)

Plant Disease Research Unit
Peter Abrahamian (peter.abrahamian@usda.gov)
Ruhui Li (ruhui.li@usda.gov)