Apple CGC Minutes
April 15, 2020; 2:30-5:00 EDT
Teleconference hosted by Plant Genetic Resources Unit (PGRU)
Geneva, NY

Attendees (and introductions): Gayle Volk (chair), Herb Aldwinckle, Peter Bretting, Susan Brown, Dawn Dellefave, Kate Evans, Gennaro Fazio, Ben Gutierrez, Nick Howard, Oscar Hurtado-Gonzales, John Keeton, Gary Kinard, Jim McFerson, Cameron Peace, Greg Peck, Chris Richards, Stijn Carlo L Vanderzande, Gan-Yuan Zhong

Minutes provided by: Gayle Volk

National Program Report. (Bretting, see attached)

NGRL Report. (Kinard, see attached for details) A Malus doumeri exploration in Vietnam was funded for Volk and Chao in 2019, and Volk has also received funding to return to Vietnam in 2020 (exploration may be delayed until 2021). A new GRIN-Global public interface will be released in the near future.

APHIS Report. Oscar Hurtado-Gonzales is the APHIS contact for the status of pome (apple, pear, quince) quarantine materials. In addition to previously established molecular & phenotypic testing of accessions in quarantine, next generation sequencing protocols are under development. A presentation was given to the committee, and a written report is attached. There was a discussion about new possible pathogens that are identified by APHIS using molecular techniques, such as AHVd (Apple Hammerhead Viroid). APHIS is planning some survey studies to determine the extent of AHVd (and other possible pathogens) in trees that are in cultivation in the U.S. There was also discussion about the need for 3 years of field testing to determine if trees are pathogen-free, now that molecular testing is available. Richard Slocum (APHIS tissue culture technician) did some training in the Volk lab at NLGRP to learn cryopreservation/cryotherapy techniques. Those methods have not yet been successfully implemented at PGQP. A new training module with apple shoot tip cryopreservation video demonstrations is being developed at NLGRP and will be shared with PGQP when it is compete. See attachment.

NPGS Training Program. (Volk) An NPGS training program is being developed. A conference was held in Fort Collins April 24-26, 2018 to design a training program. The proposed program will likely include publicly available "learning objects" (5-15 minute segments of information), university taught web-based classes that are available to students at multiple universities and internationally, and hands-on workshops on specific topics. A NIFA Higher Education Challenge Grant has been submitted to help support course development, and NPGS sites are encouraged to begin development of learning objects, with the goal of teaching specific concepts and/or techniques (contact G. Volk for more information). At this time, 8 ebook chapters are available on the topic of Crop Wild Relatives (https://colostate.pressbooks.pub/cropwildrelatives/) and 1 ebook chapter is available on the topic of apple dormant bud cryopreservation (including grafting) (https://colostate.pressbooks.pub/clonalcryopreservation/chapter/apple-dormant-bud-cryopreservation/). An apple shoot tip cryopreservation ebook chapter is being developed.

Curator Report (Gutierrez, see attached—both written and PDF versions)

The PGRU is operating under a maximized telework situation, with a field crew (supervised by John Keeton) that is in compliance with social distancing requirements. Ben Gutierrez is the acting curator for the apple collection, as a result of Thomas Chao's departure in July 2019. The position description for hiring a new curator is under development. The PGRU greenhouses experienced a fire in April 2019. No collection accessions were lost, however there was extensive greenhouse damage and smoke damage in the laboratories. Some facility operations have been relocated elsewhere on the Cornell Geneva campus.

Highlights:

Accessions: The PGRU has 5458 field accessions with 2572 permanent field accessions and 2886 seedling accessions. There are also 1643 Malus seed accessions from 31 species with over 500,000 seeds.

PGRU received new seed accessions from the Royal Botanic Gardens, Kew, Millennium Seed Bank Partnership. This exchange included 43 accessions from 5 wild *Malus* species from 7 countries. New to the collection are *Malus chitralensis* (n=4) from Pakistan and *Malus crescimannoi* (n=1) from Italy. PGRU germinated a small amount of seed of these species, as well as some seed lots of *Malus sylvestris* from Italy, a unique region for this species in the collection.

APHIS quarantine provisionally released 18 apple varieties and fully released 1 apple variety to the collection.

Distribution. The PGRU received 331 order requests in 2019, for a total of 6,671 budwood samples and 584 samples of other types (leaves, fruit, etc). Over half of the sample requests were for non-research requests. Given the high costs of collection and shipping, the PGRU has changed their distribution policies. A total of 10 accessions will be distributed per request, which is less than the 25 that were previously provided. The scion request deadline has moved to November 1, so that orders can be sorted and collected strategically. A new letter will be provided to requestors who ask for material that is commercially available, encouraging those people to obtain materials from sources that can be found online (see attached letter to the minutes). Email or paper requests for materials will no longer be accepted from most requestors. Budwood requests for grafting materials will be redirected to commercial sources.

GRIN-Global documentation. The curation team is actively updating GRIN-Global to fix errors in the records. They are also requesting feedback from the community so that data for the collection can be uploaded into GRIN-Global. Volk's group is working with the curator to update the SSR data for the collection that are in GRIN-Global.

W3 Block: The W3 wild species block is being repropagated to capture the diversity before the block of trees is removed. A total of 42 accessions have been successfully repropagated at this time. Grafting success rates have been lower than anticipated. The back-up/conservation status of this block will be re-assessed to identify a way to preserve key accessions successfully.

Impact statement. The Apple CGC requested that the curation team develop an Impact statement for the apple collection. A draft statement was provided to the committee, which will be updated via email.

Cryopreservation back-up. In 2019-2020, NLGRP doubled the capacity for dormant bud cryopreservation. Several accessions of apple budwood were provided to NLGRP (Volk) for research to

determine if cryopreserved dormant apple buds could be recovered using tissue culture to increase the viability levels of some difficult-to-cryopreserve wild *Malus* species. Hopefully, between 50 and 100 new accessions of *Malus* can be cryopreserved as dormant buds in the upcoming years.

Threats. Fire blight continues to be the greatest challenge for the collection. It is mananaged through standard control practices and careful monitoring of susceptible accessions. PGRU is evaluating the performance fireblight resistant rootstock G.890 for compatibility with diverse germplasm.

CGC Evaluation Award for 2019. Volk, Peace, Luby, Howard, et al. received an evaluation award in 2019 to collect SNP data on NPGS accessions. Leaf samples were obtained from PGRU in the spring of 2019 and the extractions were outsourced. The quality and quantity was insufficient for SNP analyses, so DNA extractions are being repeated in-house. Several hundred samples have been provided to Michigan State for SNP analyses, and additional leaves will be requested to complete the project this spring. Data will be analyzed by Nick Howard. Information about pedigrees, trueness to type (matches with other collections), and potential hybrids will be made available.

Vulnerability Statement and Quad Chart updates. The current apple vulnerability statement has been published: Volk et al. 2015. The vulnerability of U.S. apple (Malus) genetic resources. Genetic Resources and Crop Evolution 62: 765–794. We also have a "Quad Chart" that summarizes the vulnerabilities of the apple genetic resources in the U.S. Both of these items will be circulated and a short update will be written and posted on the Apple CGC website. In addition, the Global Conservation Strategy for Apple has been released: https://cdn.croptrust.org/wp/wp-content/uploads/2019/11/Apple-Conservation-Strategy.pdf

Subcommittees proposed at the last CGC meeting have not met: The CGC agreed that these subcommittees are important and the planned efforts should continue via email.

New Core Subcommittee:
Researchers would like access to replicated core set samples for research purposes. The current core collection has about 2 replicates in the field per tree in Geneva. Some core collection trees are also available elsewhere (such as at WSU-Wenatchee. There is also concern about the coverage of the core collection. Discussions will include the value/need for specific core sets of trees (because each researcher may want a different core) and if replicated plantings could be established (likely not at PGRU, due to limited field space).

Land Use Efficiency Subcommittee:
What is needed to accomplish the PGRU mission with respect to Malus conservation?
Identify a plan for using the available space
Options with respect to renewing the current PGRU lease, which will expire in ~15 years.
Assess field use strategy for existing space
Identify priorities for new acquisitions into the collections that will be maintained in the field.
Identify options for the use of future space, if more were to be made available
    Identify desired crosses/population size for future pre-breeding seedling plantings
    Maintenance resources necessary for future space options

The National Plant Germplasm System: 2020 Status, Prospects, and Challenges

Peter Bretting
USDA/ARS Office of National Programs
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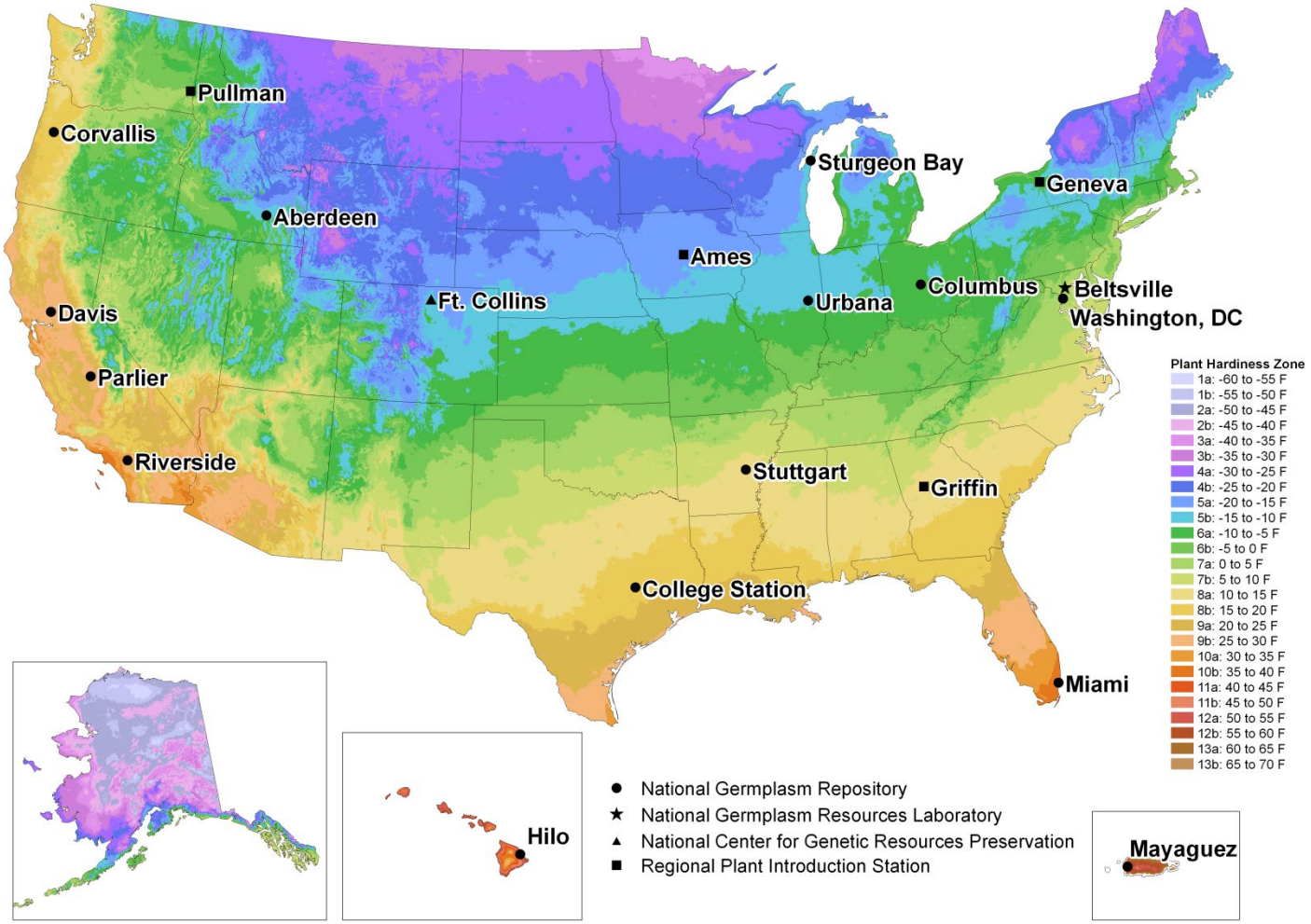
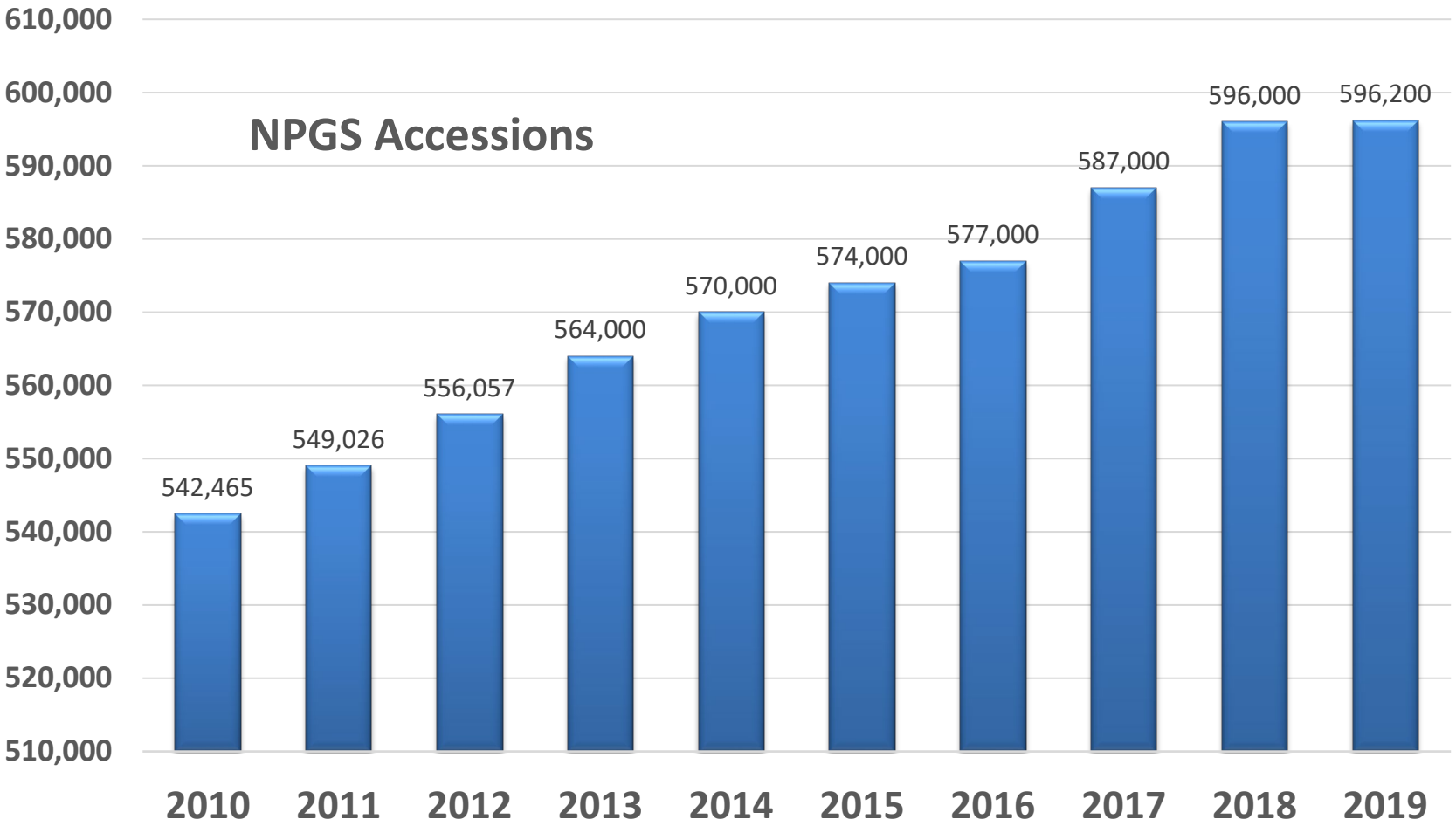
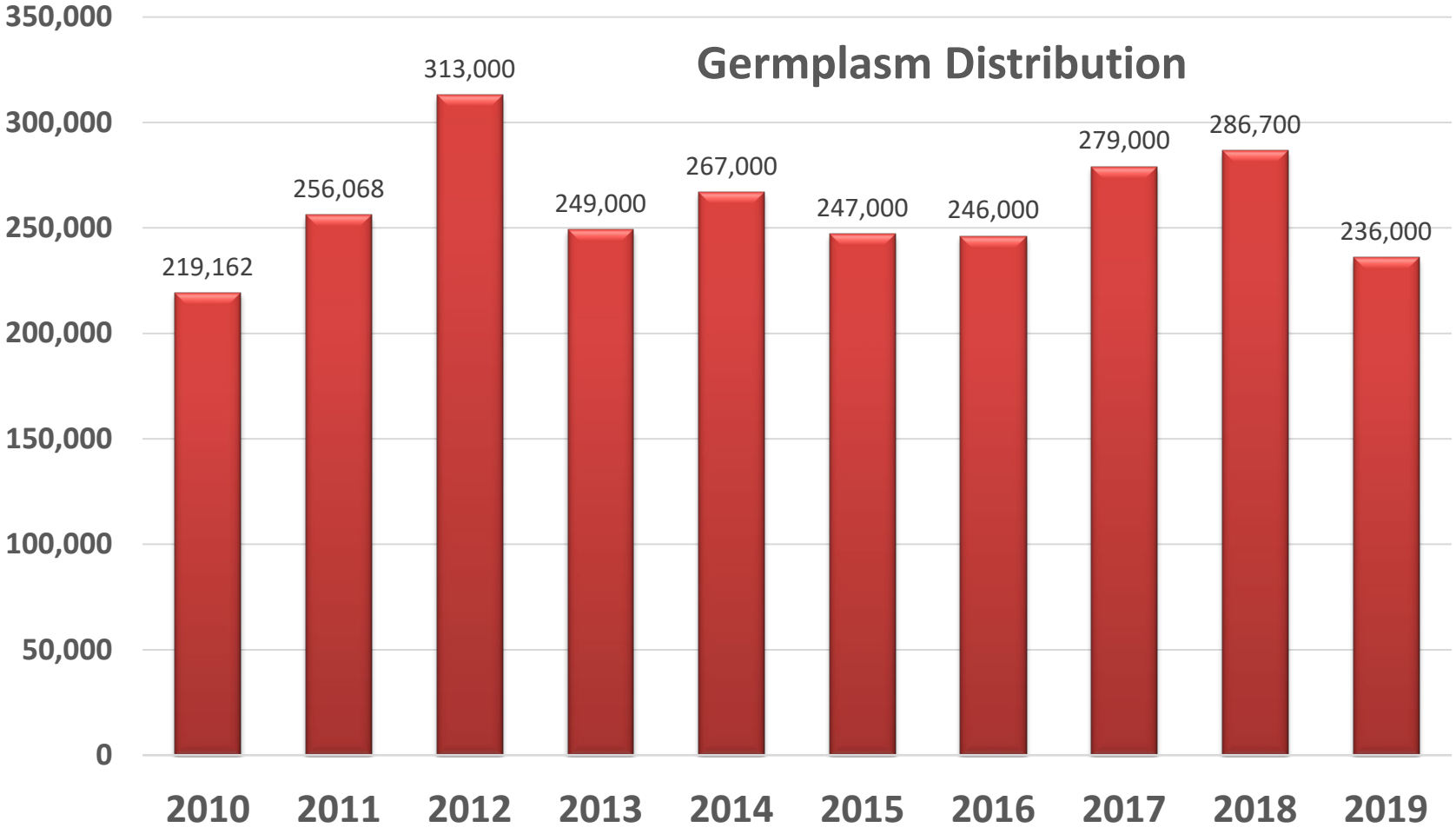
USDA National Plant Germplasm System (NPGS)



Number of NPGS Accessions 2010-2019



Demand for NPGS Germplasm 2010-2019



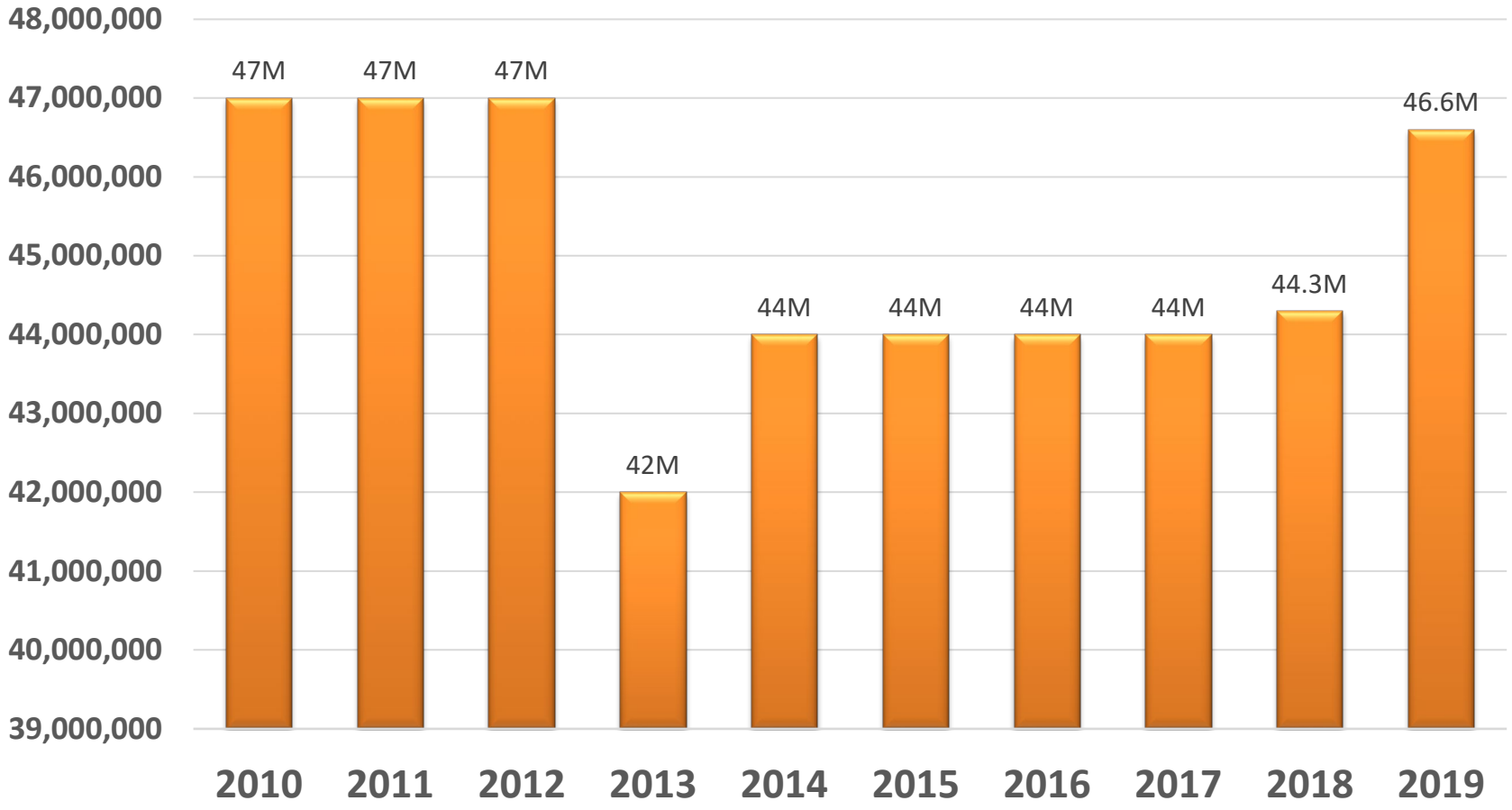
Effects of CoVID-19 as of 9 Apr 20

- **Most international germplasm shipments have been ceased because of uncertain delivery conditions at requestors' locations.**
- **Many NPGS genebanks have ceased all germplasm shipments because of Federal, State, and local (university) directives for social distancing, stay-at-home, etc. But Aberdeen, Ames, Corvallis, Davis, Mayagüez, Pullman, and Sturgeon Bay are still shipping some germplasm.**
- **GRIN-Global is functioning normally.**

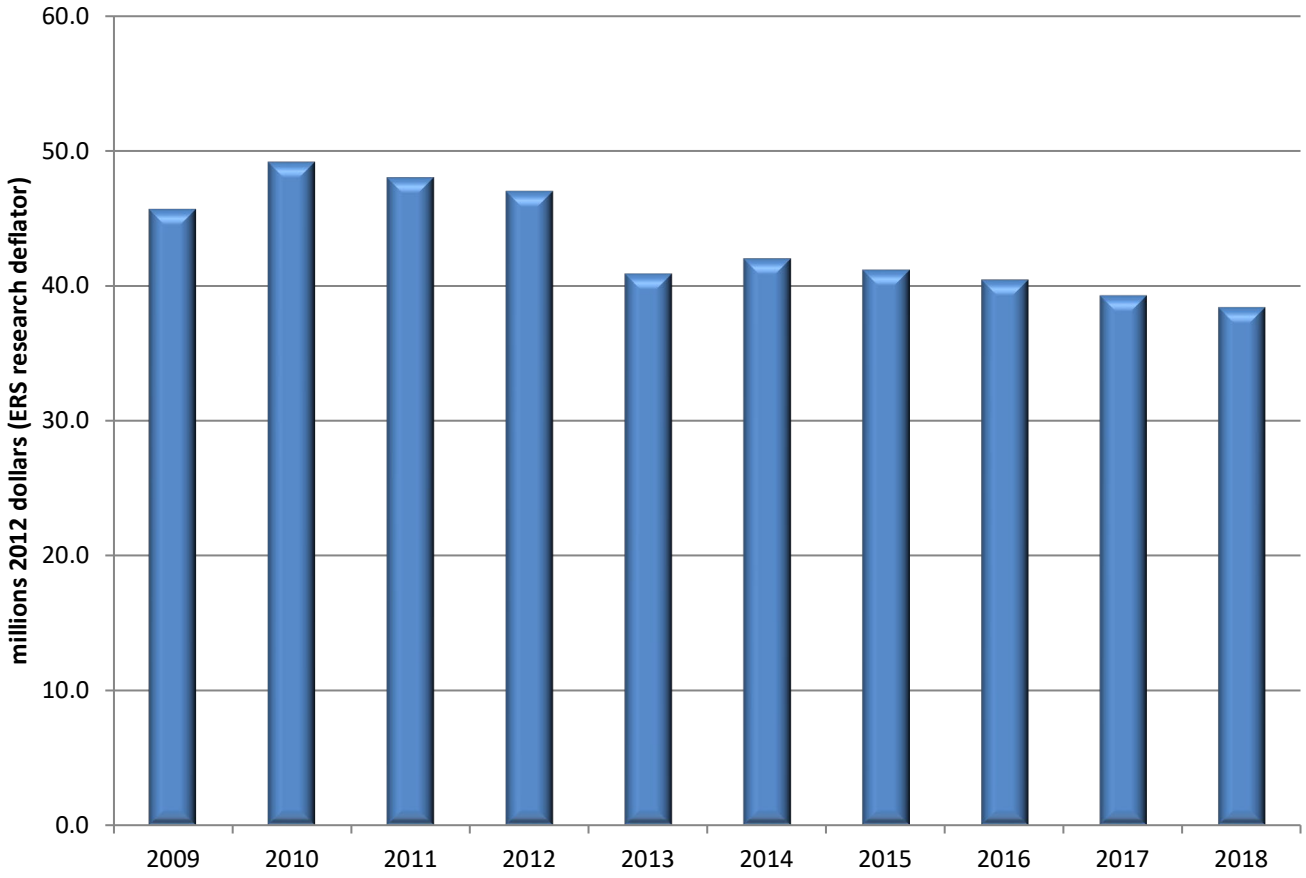
ARS National Plant Germplasm System

BUDGET

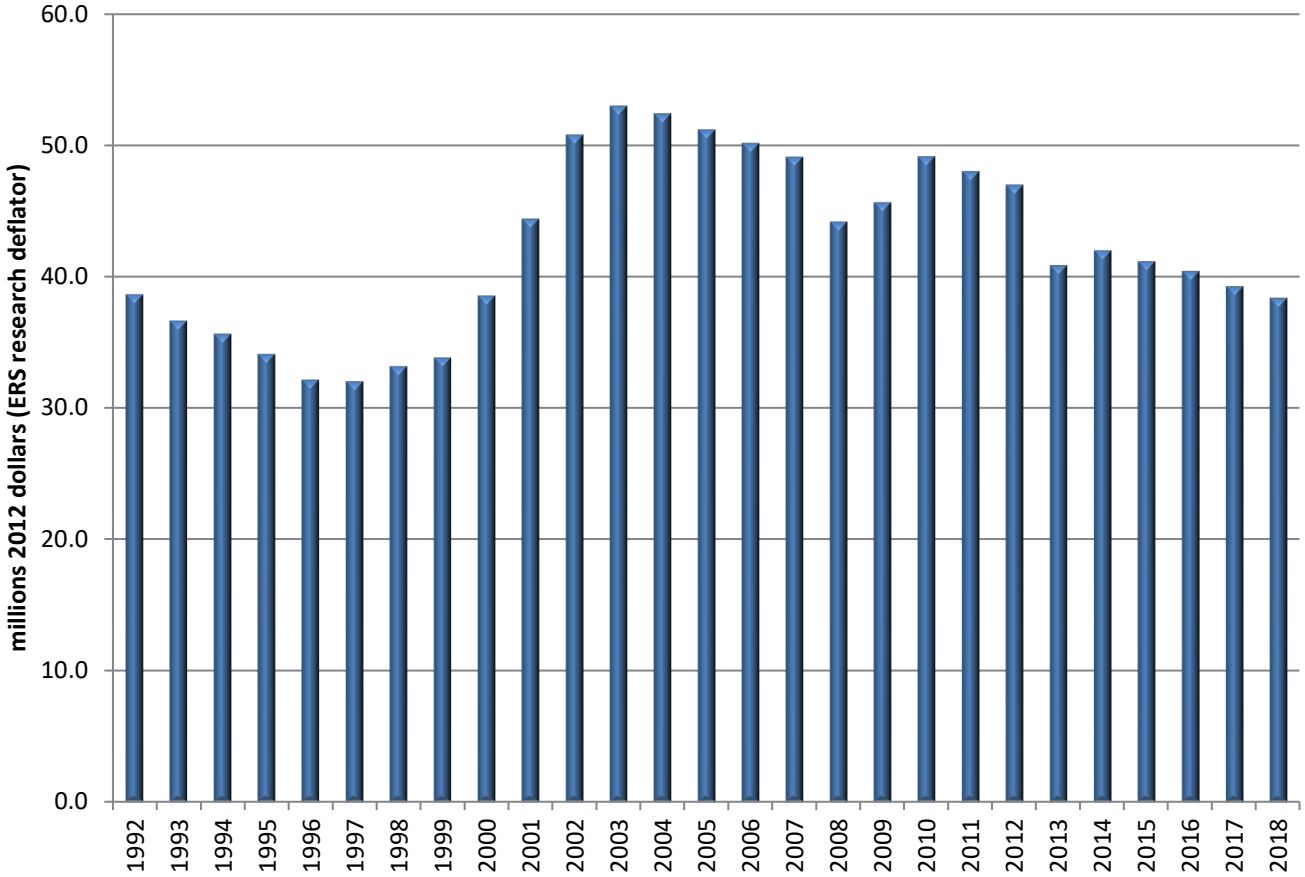
2010-2019



ARS NPGS real (deflated) budget, 2009-2018



ARS NPGS real (deflated) budget, 1992-2018



Some key challenges for the NPGS

- **Managing and expanding the NPGS operational capacity and infrastructure to meet the increased demand for germplasm and associated information.**
- **Recent and upcoming NPGS personnel retirements; hiring and training new staff.**
- **Developing and applying cryopreservation and/or in vitro conservation methods for clonal germplasm.**
- **BMPs and procedures for managing accessions (and breeding stocks) with GE traits and the occurrence of adventitious presence (AP).**
- **Acquiring and conserving additional germplasm, especially of crop wild relatives.**

Genetic Resource Management Priorities: Foundations for Crop Innovation

- Acquisition
- Maintenance
- Regeneration
- Documentation and Data Management
- Distribution

- Characterization
- Evaluation
- Enhancement
- Research in support of the preceding priorities

Personnel Changes

- **Farewell and best wishes to John Wiersema, (ARS-Beltsville); Dave Stout, Frank Dugan, Ted Kisha, Vicki Bradley (ARS-Pullman); Harold Garrison (ARS-Davis); Joseph Postman, Jack Peters, (ARS-Corvallis); Thomas Chao (ARS-Geneva); Quinn Sinnott (ARS-Beltsville). We mourn the passing of Phil Stinard (ARS-Urbana) and Heidi Schwaninger (ARS-Geneva).**
- **Welcome and best wishes to Ben Gutierrez, cold-hardy grape curator and Joanne Labate vegetable curator (ARS-Geneva); Trevis Huggins, rice curator (ARS- Stuttgart); Vivian Bernau, a second maize curator and Anna Testen, plant pathologist (ARS-Ames); Benjamin Haag, IT specialist (ARS-Beltsville); and Scott McNeill, agronomist (ARS-Aberdeen) .**
- **With the hiring freeze lifted, we hope to hire curatorial staff in the near future at Hilo, HI; Pullman, WA; Corvallis, OR; Geneva, NY; Miami, FL and Urbana, IL.**

Plant Genetic Resource (PGR) Management Training Initiative

- **At least 1/3 of NPGS PGR managers could retire within 5 years.**
- **Currently, no formal, comprehensive program exists for training new PGR managers.**
- **G. Volk (ARS-Ft. Collins) and P. Byrne (CSU-Ft. C.) secured a USDA/NIFA grant for a workshop at Ft. C. 24-26 April 2018 that discussed designing & developing a training program for PGR management to be delivered primarily through distance-learning.**
- **The workshop generated numerous insights; workshop participants submitted a NIFA Higher Education Challenge grant proposal that awaits funding. An extensive survey for PGR training/learning needs was conducted and published in Crop Sci. 59:2308–2316 (2019). doi: 10.2135/cropsci2019.05.0324**
- **Instructional e-books under development--see https://colostate.pressbooks.pub/cropwildrelatives/ for an e-book about conserving crop wild relatives.**

FY 19 ARS NPGS Budgetary Increases

- **Coffee genetic resources ($1.9 million): Hilo, HI; Mayagüez, PR; Ft. Collins, CO; Beltsville, MD.**
- **Citrus genetic resources ($1 million): Riverside, CA; Ft. Collins, CO.**
- **Industrial hemp genetic resources ($500,000): Geneva, NY.**

NPGS Video

- **Pullman, Griffin, Ames, Corvallis, and Geneva staff developed a new tactic for discouraging "non-research requests" for germplasm by communicating that the NPGS benefits everyone by ensuring global food security through research and breeding, not by providing seeds for home gardens.**
- **Led by Barbara Hellier at Pullman, the NPGS genebanks and USDA Communications filmed a video of NPGS operations accessible from the ARS YouTube site at: https://youtu.be/uHOclGNELuw**
- **Feel free to post this link on your websites, and share it with customers/stakeholders, colleagues, family, and friends.**

USDA-ARS
National Germplasm Resources Laboratory
Beltsville, Maryland
2020 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).

Quinn Sinnott retired in August 2019 after more than 30 years of service as the GRIN Database Administrator. Fortunately, we used a vacant position to hire a new IT Specialist, Benjamin Haag, who started in April 2019 and benefitted from overlapping with Quinn for about four months. Benjamin came to ARS from the IT group at the Kennedy Center for the Performing Arts in Washington, DC; he also has previous federal service with the National Institute of Standards and the Department of State/Peace Corps.

There are four positions currently vacant in NGRL, including a Botanist position in the PEO. We hope to fill most, if not all, of these positions in 2020 consistent with an increased emphasis by ARS on recruiting vacant positions.

Plant Exchange Office

Plant Exploration and Exchange Program:

- The PEO supports the collection of germplasm for the NPGS through the management of a Plant Exploration and Exchange Program. Guidelines for developing plant exploration and exchange proposals will be distributed to CGC chairs in February 2020. Proposals must be endorsed by the appropriate CGC or other crop experts.
- The deadline for submitting proposals for explorations or exchanges to be conducted in FY 2021 is July 24, 2020.
- All foreign explorations supported by PEO 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 is involved in most requests to foreign governments for permission to collect and negotiates the terms of agreements when necessary.

FY 2019 NPGS Plant Explorations

Target crop/taxon	Country	Principal contacts
Wild apple	Vietnam	G. Volk, T. Chao, T. Hoai, N. Van Klein

Woody landscape plants	Georgia	T. Kurdadze, M. Khutsishvili
Wild potato	United States (AZ, CO, NM, UT)	J. Bamberg, C. Fernandez, A. del Rio, I. Bamberg, M. Martin
Cladrastis kentukea	United States (KY)	J. Campbell
Amelanchier spp.	United States (KY)	J. Campbell
Monarda brevis	United States (WV)	J. Carstens
Amaranthus spp.	United States (AZ, CA, NM, TX)	K. Waselkov
Parthenium argentatum	United States (TX)	C. Heinitz, H. Abdel-Haleem, G. Ponciano, P. Manning
Woody landscape plants	United States (NC, TN)	M. Lobdell, K. Shearer
Chenopodium spp.	United States (CA, CO, OR)	R. Jellen
Wild blueberry	United States (FL)	G. Nunez

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

In 2016, ARS and the U.S. Forest Service established an agreement to foster collaboration on conservation of crop wild relatives on U.S. National Forests. A pilot project is currently underway to evaluate the suitability of the Wild Chile Botanical Area in the Coronado National Forest, AZ as an *in situ* reserve for multiple species of crop wild relatives. The project is a collaborative effort of the US Forest Service, Borderlands Restoration Network, the University of Arizona, and ARS. In addition to wild chiles, wild relatives of cotton, beans, cassava, grapes, passion fruit, walnut, squash, sunflower and other crops occur in the Botanical Area.

GRIN Taxonomy for Plants:

- GRIN Taxonomy, available through GRIN-Global (https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomyquery.aspx), provides online current and accurate scientific names and other 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. 16,000 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.
- GRIN Taxonomy includes scientific names for 27,533 genera (14,430 accepted) and 1,422 infra-genera (1,360 accepted) and 117,688 species or infra-species (66,030 accepted), with over 67,292 common names, geographical distributions for 28,902 taxa, 481,197 literature references, and 38,146 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 241 major and minor crops from 120 genera, and 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. A new CWR page is being developed and should be released in 2020 to allow users to search for trait class and breeding type data contributed by the Global Crop Diversity Trust.

Facilitation of Germplasm Exchange:

The PEO helps expedite the distribution of germplasm from the NPGS to foreign scientists and other international genebanks through a long-standing collaboration with USDA-APHIS at Building 580, BARC-East. In 2019, 579 public orders containing a total of 44,786 samples of NPGS accessions were shipped from Beltsville to individuals in 69 countries around the world for research and education. In addition, PEO facilitated the agricultural inspection of arriving germplasm shipments containing accessions from numerous foreign countries for researchers and curators at NPGS sites.

Crop Germplasm Committees:

- The CGC section in GRIN (https://www.ars-grin.gov/CGC) was revised when the GRIN platform was migrated to the Microsoft Azure cloud in September 2019.
- A new coffee and cacao CGC has been created consistent with new funding allocated to ARS by Congress to establish collections for these crops.
- Please send updates to the individual crop committees of the CGC page on GRIN (https://www.ars-grin.gov/CGC) to Gary Kinard.
- Most committees continue to meet regularly and are active. Committees are particularly urged to update their Crop Vulnerability Statements and several CGCs recently completed new versions.
- A virtual meeting/web conference was held for CGC Chairs on March 25, 2019. Updates were provided from ARS and the NPGS including on international issues related to plant genetic resource exploration and exchange, GRIN-Global, and the activities of the CGCs.
- NGRL has a WebEx conferencing account that is available to the CGCs to host virtual meetings (teleconference and/or webinar).

Database Management Unit

GRIN and GRIN-Global:

- At the time of this report, the GRIN-Global plant database included the following:

  596,132 active accessions representing 13,481 species and 2,497 genera
  3,353,167 inventory records
  2,050,371 germination records
  8,414,832 characteristic/evaluation records
  469,116 digitized images

Many of these numbers increase almost daily.

- The entire GRIN platform (all databases and informational pages) were migrated from in-house servers to the Microsoft Azure cloud in September 2019. At that time, the GRIN home page (www.ars-grin.gov) was totally redesigned with new navigation for the ARS genetic resource collection informational pages, the Crop Germplasm Committee pages and the content for the National Genetic Resources Advisory Council.
- New email accounts were established for the NPGS internal email lists during the migration to the cloud. The older email addresses for curators, CCG Chairs, and PGOC members were disabled and can no longer be used. Information about this change was distributed in September 2019.
- We anticipate releasing a new version of the GRIN-Global (accession search, accession detail, germplasm requests, etc.) public website in spring 2020.
- Current information about the project, including user documentation and release notes from each version of the software, can be found on the project website at https://www.grin-global.org/.

Plant Disease Research Unit

The PDRU conducts research on pathogens that infect clonally propagated prohibited genus (i.e., quarantine) plant germplasm, including their 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 on virus related problems with NPGS germplasm repositories, state departments of agriculture, and university scientists. Additional updates will be provided for those committees whose crops are within the scope this project's research.

Key NGRL Contacts

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USDA
United States Department of Agriculture

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Plant Germplasm Quarantine Program

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2019 Annual Report to the Apple Crop Germplasm Committee
USDA- APHIS
Plant Germplasm Quarantine Program
By Dr. Oscar P. Hurtado-Gonzales

Personnel Changes at PGQP

In August 2019, Dr. Xiaojun Hu, former Research Scientist with the NIH, joined PGQP as the Bioinformatician Lead Scientist of the Plant Germplasm Quarantine Program. Dr. Hu (Alex) main role is to develop pipelines for the accurate detection of viruses, viroids and other plant pathogens based on high-throughput sequencing across all the 30 different genera processed by PGQP.

Quarantine Activities

Status of Accessions

The Plant Germplasm Quarantine Program (PGQP) imports fruit introductions, propagates them, tests them for pathogens, performs therapy if necessary, and releases them to importers and repositories. In 2019 the Pome quarantine program had 5 Malus final releases as well as 14 Malus provisional releases. Additionally our program is currently processing 274 accessions (146 Malus, 112 Pyrus and 16 Cydonias) and interacts regularly with importers, including the Pomes Repositories, Crop Germplasm Committees, university breeders and horticulturists, scientists of the National Clean Plant Network, commercial nurseries, and private growers. As soon as testing results are available (generally February of every year), PGQP generates a status report for each imported accession and takes the necessary actions to move the accession to the next step in the quarantine process (further diagnostics based on bioassays or RT-PCR, therapies when needed, and/or field indexing). The Pomes Quarantine program is the lengthiest of all 30 genera handled by PGQP due to various factors such as slow growth of the imported germplasm, infected imported germplasm requiring time-consuming and lengthy therapies, and a 3-4 year period of field indexing using various field indicators.

In 2019, PGQP received and established a total of 25 Pome accessions itemized as follows: 1 apple from South Africa, 10 apples and 10 pears from Kyrgyzstan, 1 apple and 2 pears from Germany and 1 apple from Czech Republic. Our current screen house inventory contains more than 1300 trees including clones, sub-clones, therapy

clones, provisional releases, old releases, legacy trees, old interceptions, and positive controls.

Pathogen Detection

Every year we detect pathogens in imported pomes. Pathogen detection is done using indicators plants, RT-PCRs, and the newly implemented high-throughput sequencing procedure. Up to 60% of the imported germplasm is detected to contain one or more plant virus, viroid, and/or phytoplasmas. RT-PCR-based detection now includes five recently identified plant pathogens in the past few years. These new pathogens include Apple Hammerhead Viroid (AHVd) found in apples, Citrus Virus A (CiVA) found in Pears and Quinces, Citrus Concave Gum-associated Virus (CCGaV) found in apples, Apple Luteovirus 1 (ALV1) found in apples, and Apple Rubbery Wood-associated Virus (ARWaV-1 and ARWaV-2) found in apples and pears. Altogether, RT-PCR pathogen detection includes **six viroids**, **nine viruses**, and **one phytoplasmas test**. During 2019 we conducted about 960 bioassays corresponding to 47 unique accessions, 924 nucleic extractions corresponding to 274 unique accessions, and started the 3-4 year field indexing of 31 unique accessions (11 accessions in the Beltsville field and 20 in the Prosser field). During 2020 we expect to conduct all field indexing activities in Beltsville since the field operations have expanded to over 1000 field indicators.

Implementing NGS (aka HTS) Technologies at PGQP

We have enhanced our diagnostic capabilities at PGQP by implementing the use of NGS technologies as a tool for routine plant pathogen detection. This technology is aiding in the detection of known and in some cases unknown “plant pathogens”. 2019 marks the period in which the PGQP Pomes program is releasing germplasm supported by HTS data.
Since the establishment of HTS in PGQP, the Pomes program has sequenced 76 unique imported accessions (25 apples, 46 pears, and 5 quinces) and over 40 different Malus, including rootstocks from various companies, weeps from nurseries, accessions maintained in the Malus repository, etc. These activities have supported studies such the phylogenetics of ALV-1, the first report of CiVA in pears and quinces, the first report of Prunus Virus T in pears, among others. We will continue expanding our HTS activities this year by sequencing every accession prior to field indexing.

Therapy

Different heat treatment and tip grafting or tissue culture procedures are used to obtain pome and stone fruits free of detected pathogens. Moving all of the infected accessions through the therapy process efficiently has been the greatest challenge for these quarantine programs.
Richard Slocum, Tissue Culture Scientist, continues to establish accessions in tissue culture in order to put them through therapy. In the past, he has made excellent progress with apples and

pears. Richard also received training on cryotherapy during 2019 in Fort Collins, ARS. Cryotherapy has the potential to significantly reduce the therapy time (from several weeks to a few hours). Attempts to establish this technique has not been successful so far although attempts are in the pipeline. On the brighter side, the current thermotherapies and heat therapies appear to hold steady to free plants off the prevalent Apple Hammerhead Viroid. We currently have identified approximately over 40 different Malus accessions carrying this viroid alone or in combination with other viruses.

Acknowledgments

The Pome Team of PGQP:

Mr. Robert P. Jones (crop specialist)
Mrs. Anna Wunsch (student)
Mr. Joshua Mendoza (contractor)
Dr. Larissa Costa Carvalho (Test development)
Mr. Richard Slocum (Tissue Culture Therapist)

PLANT GENETIC RESOURCES UNIT REPORT TO THE APPLE CGC

April 15, 2020

Ben Gutierrez, John Keeton, Dawn Dellefave, and Gan-Yuan Zhong

OPERATIONS

Currently, PGRU is operating through maximized telework to comply with national and statewide measures to decrease the spread of Covid-19. Our field team was organized under John Keeton to complete essential tasks while adhering to guidance on social distancing. This will become increasingly challenging when faced with tasks that cannot be accomplished in isolation, such as nursery planting. As we approach bloom and fruiting seasons we will keep stakeholders informed on availability of research materials. If you have requests for pollen, summer budwood, leaves, or fruit, please send them to us as soon as possible so we can try to accommodate.

In 2018 we merged the PGRU clonal and vegetable field teams. John Keeton supervises all farm activities and coordinates with curators to accomplish our unified objectives. This change has required us to carefully review our operations and make some changes. Some of these changes will be discussed further in this report. Additionally, in 2019 the NPGS announced that industrial hemp will be included in the PGRU vegetable collection, and will likely inspire further revisions to our operations to accommodate this expansion.

Personnel

The PGRU Clonal team operates under Gan-Yuan Zhong (lead scientist), Ben Gutierrez (curator), Dawn Dellefave (program support/database manager), John Keeton (farm manager), and four permanent field technicians, with USDA-ARS PGRU and NE9 funding. In 2019, David Osborne was hired to the permanent NE9 staff. PGRU has two critical vacancies, Apple/Tart Cherry Curator (vice Chao) and Molecular Biologist (vice Schwaninger). Ben Gutierrez is currently the acting curator for Apple and Tart Cherry. We anticipate the PGRU Molecular Biologist and Curator positions will be announced later this year.

PGRU hosted four interns in 2019 through various USDA and Cornell University programs. PGRU is well positioned to offer research experience for undergraduate students in horticulture, genetics, and data analysis. These interns completed small scale research projects evaluating the tart cherry and grape collections. Additionally, they supported PGRU in collecting samples for stakeholders, including apple leaves for virus testing and fruit for aroma analysis. One intern, Kyra Battaglia, University of Rochester ‘19, stayed on for the entire year and supported our characterization and distribution efforts and co-led tours of the collection. This season we hope to have two additional interns join us.

Facilities

In April 2019, PGRU lost its greenhouses and headhouse to a fire, which also caused significant damage to PGRU’s laboratory. Lab equipment was relocated to Surge Lab on the Cornell AgriTech campus and temporary greenhouse space was provided by the USDA Grape Genetics Research Unit. Because of this support, we are now able to resume full operational activities. Although not destroyed by the fire, PGRU screenhouses will be included in the demolition of our old building. For now, we are still able to use them but are seeking to renovate existing USDA screenhouses as a replacement. To expand our characterization capacity, PGRU acquired a GC/MS and an LC/MS for metabolite evaluations for all PGRU crops.

NEW ACCESSIONS

PGRU received new seed accessions from the Royal Botanic Gardens, Kew, Millennium Seed Bank Partnership. This exchange included 43 accessions from 5 wild *Malus* species from 7 countries. New to the collection are *Malus chitralensis* (n=4) from Pakistan and *Malus crescimannoi* (n=1) from Italy. PGRU germinated a small amount of seed of these species, as well as some seed lots of *Malus sylvestris* from Italy, a unique region for this species in our collection. These seedlings will be evaluated and included in the permanent collection. Additionally, Gayle Volk and Thomas Chao led a successful exploration for *M. doumeri* in Vietnam. Field accessions for this species will be maintained in Corvallis, Oregon, USA.

STATUS OF W3 BLOCK

Various selections were made within the W3 *Malus* seedling block, based on species and family diversity. PGRU propagated seedlings on two rootstocks, G.890 and EMLA 7, using dormant scions and summer budwood. Each seedling was double budded on two of each rootstock (four trees/seedling). We've had poor success rates for both attempts and on both rootstocks (~30%), compared to other material grafted at the same time (70% success). **Table 1** below outlines the results, with success defined as survival of one or more trees. We will attempt one final propagation with this approach using summer budwood in 2020.

Table 1. W3 grafting success rates for dormant and summer budwood

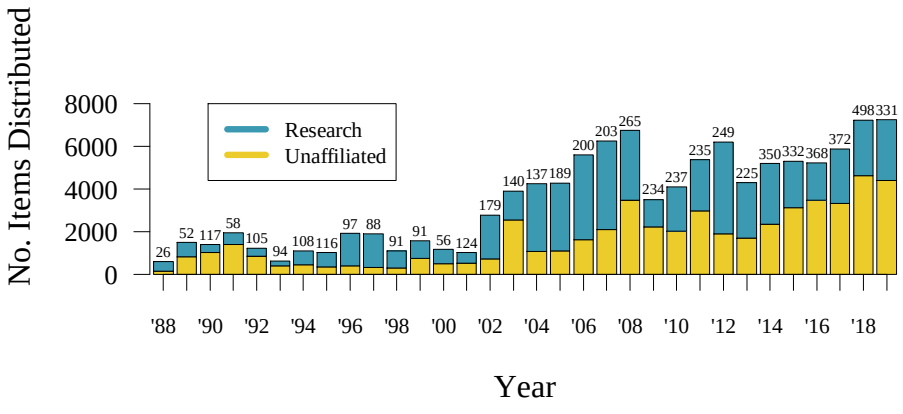
Material	No. Accessions	EMLA 7 Success	G.890' Success	Successful Accessions
Winter (2019)	90	26	16	30 (33%)
Summer (2019)	135	33	24	42 (31%)

GERMPLASM REQUESTS AND DISTRIBUTION

Overview of PGRU Distribution

Distribution of genetic material is the most valuable service PGRU provides to its stakeholders. The number of requests accepted and samples distributed continues to increase (**Figure 1)**. PGRU classifies each recipient by their affiliation, which can be broadly categorized into either research groups or unaffiliated individuals (non-commercial, non-university). Over the past several years, the majority of PGRU distribution has served this group of unaffiliated individuals. Although the number of completed requests decreased to 331 in 2019 (Figure 1), the volume of samples was the same as 2018, which had 498 requests.

Figure 1. Number of items distributed from the *Malus* collection from 1988 to 2019 separated by Research (blue) and Unaffiliated (yellow) recipients. Total number of requests indicated above bar



New Distribution Policy

We have modified our request and distribution policies to ensure PGRU's resources and efforts are focused on mission critical activities and serving scientific research-oriented and educational-related objectives of state, federal, or commercial entities. Many of these modifications are a reflection of our field management changes, and we hope this will allow us to focus more on the maintenance and future growth of the collection.

Flexibility is one of PGRU's greatest strengths. If you have feedback on these changes or other request/distribution practices, please let us know how to improve. These policy changes include:

- New scion request deadline of November 1 (changed from January 15)
  - This ensures scion collection is completed so our field team can prune more of the apple collection to substantially reduce the cost of University pruning services.
  - We will continue to be flexible, but please no more 'March 1' requests! Let us know your plans so we can support you.
- New limit of 10 accessions (changed from 25)
  - Most non-research requests order the maximum number of accessions.
  - No limit for research requests (within reason)
- Catalogues and Write-in Requests Discontinued
  - We removed catalogues from our website and requestors encouraged to use GRIN-Global
  - Researchers can continue to request material directly from PGRU
- Scion requests for grafting classes and demonstrations no longer accepted
  - We receive many large requests for grafting classes which could be better supplied by industry partners.
- Top Commercial Cultivars Listed as 'Unavailable' on GRIN
  - **Table 2** lists the top requested cultivars from 1989 to 2019. Due to the high volume of requests for these accessions for non-research purposes and because they can be commercially sourced, we have listed these as 'Unavailable' so they cannot be requested through GRIN. *However, they are still available for legitimate research*. To search for them on GRIN, you need to select the 'Include Unavailable' option. We will work with the GRIN team to identify a more appropriate classification for these types of accessions.
- Non-Research Requests
  - Every year we receive hundreds of requests for germplasm that do not meet the legitimacy requirements established by the NPGS. For now, the individual repositories determine which requests are legitimate or not but many slip through the cracks. To more uniformly respond to these requests and reduce the time we spend on each one, we have drafted a statement to educate these requestors on the NPGS mission and encourage them towards commercial sources for material. Suitable nurseries can be found through a simple internet search.
- Research requests:
  - *We strongly encourage researchers to notify us of their intended use of the collection.* If requesting fruit, please notify us well in advance so we can arrange with our staff and coordinate with other requestors. We're also discouraging researchers from collecting large scion orders. If you need support, let our team serve you!

Table 2. Top requested accessions from the National Apple Collection from 1988 to 2019

Accession	Species	Cultivar	Times Shipped
PI 588853	*M. domestica*	'Cox's Orange Pippin'	391
PI 588785	*M. domestica*	'Esopus Spitzenburg'	338
PI 589654	*M. domestica*	'Ashmead's Kernel'	327
PI 589892	*M. domestica*	'Golden Russet'	321
PI 588971	*M. domestica*	'Roxbury Russet'	310
PI 588943	*M. domestica*	'Liberty'	300
PI 589596	*M. domestica*	'Calville Blanc'	298
PI 613818	*M. domestica*	'Wickson'	280
PI 588791	*M. domestica*	'Grimes Golden'	269
PI 588872	*M. domestica*	'Northern Spy'	269
PI 588803	*M. domestica*	'Chestnut Crab'	265
PI 589073	*M. domestica*	'Dabinett'	260
PI 590157	*M. domestica*	'Hudson's Golden Gem'	249
PI 588842	*M. domestica*	'Empire'	239
PI 589117	*M. domestica*	'Arkansas Black'	239
PI 588861	*M. domestica*	'Winter Banana'	223
PI 588799	*M. domestica*	'Winesap'	213
PI 123960	*M. domestica*	'Court Pendu Plat'	212
PI 588807	*M. domestica*	'Wolf River'	207
PI 589703	*M. domestica*	'Kingston Black'	207
PI 589906	*M. domestica*	'Sweet Sixteen'	205
PI 590180	*M. domestica*	'Blue Pearmain'	204
PI 588980	*M. domestica*	'Pink Pearl'	201
PI 588773	*M. domestica*	'Yellow Newtown'	200
PI 588788	*M. domestica*	'Wealthy'	199
PI 588870	*Malus* hybrid	'Dolgo'	199
PI 589697	*M. domestica*	'Stoke Red'	198
PI 588806	*M. domestica*	'Chisel Jersey'	197
PI 589894	*M. domestica*	'Keepsake'	196
PI 588844	*M. domestica*	'Fuji'	195
PI 223602	*M. domestica*	'Mutsu'	194
PI 589469	*M. domestica*	'Haralson'	194
PI 392303	*M. domestica*	'Gala'	193
PI 588880	*M. domestica*	'Granny Smith'	193
PI 300258	*M. domestica*	'Belle de Boskoop'	192

GRIN-GLOBAL

Updates to Descriptor and Passport Data

We are working with Greg Peck to update the names of cider cultivars for accuracy. This includes spelling error/transcription errors and adding accent marks. The process for updating the accession information is simple! Please let us know if you discover other mistakes or if key information should be updated. There are some obvious errors in our descriptor data; one accession is reported to have TSS of 730.00! As we go through these historic datasets we will identify suspicious data and re-evaluate the accessions.

Feedback from End-Users and a Call for Data

PGRU's central role to germplasm utilization helps us to recognize trends in use and opportunities to enhance our collections. One potential way to enrich our collections may come from you, our stakeholders. Over the 30+ years, PGRU has characterized its collections, with an emphasis on fruit quality traits. GRIN-Global holds 134,412 data points for 106 traits for our apple collection! These data become an important part of an accession's history and increases the value and accessibility of our collections as many stakeholders use this information to select

germplasm. However, we are not focused primarily on research and characterization, so we hope to lean on more of our germplasm users for data.

Other non-NPGS collections, such as the Arnold Arboretum, require an agreement for data collection and reporting following germplasm use. While we do not require a contract, at the conclusion of your study we want to include your published data in our database, which is a standard practice for scientific integrity. If your trait is not included in our descriptor list, we will happily work with the GRIN team to include any new traits. Even data collected without rigorous experimental designs could become an important addition to an accession narrative. As an example, here is an informative narrative of 'Fall Russet' from Roger Way:

> "Comments: Fruit: size medium, 65mm; skin russet; shape round-oblate; flesh semifirm, cream colored; flavor subacid; eating quality good; harvest season late September, 2 weeks before Delicious. Tree: strongly biennial. Russet, good quality."

As a breeder, R. Way had a focused approach to his narratives. Other perspectives may bring additional value. Many accessions lack a narrative and/or lack descriptor data, which may significantly reduce their usage. We would be grateful for your feedback on how to best standardize and implement this. As more of us report back, the value of the collection increases.

IMPACT STATEMENT

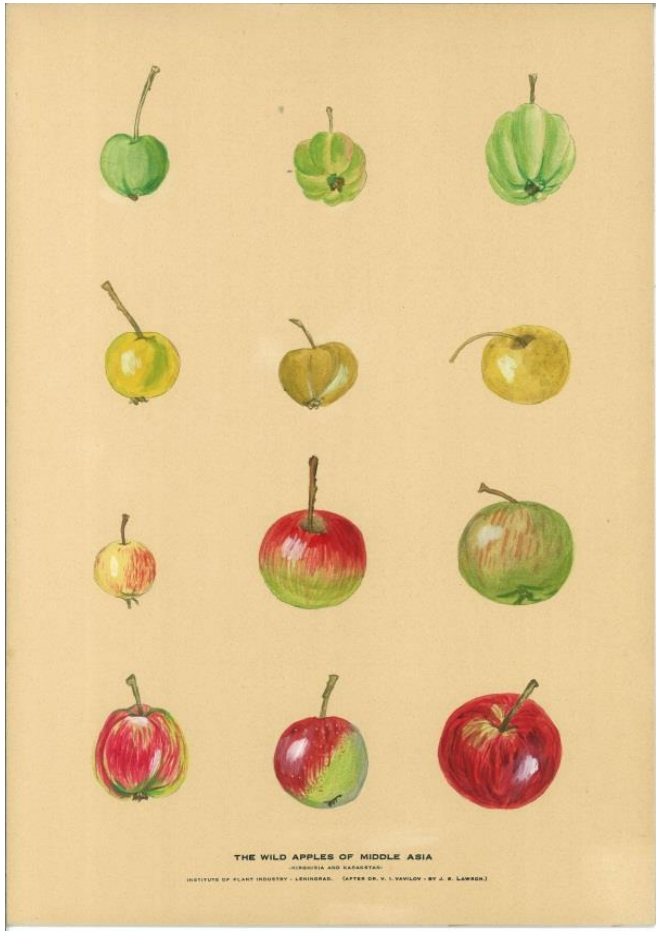
Following suggestions from the Apple CGC, we have drafted an impact statement for the PGRU Apple Collection. The purpose of this statement is to provide stakeholders with information on the collection and to better promote is visibility and future preservation. Much of this early form draws on data PGRU has collected on germplasm utilization and is part of the GRIN-Global database, though not publically available. We welcome your insight and contributions. Please share examples of how the collections has impacted your research and breeding efforts, with as much specificity as you are able.

HIGHLIGHTS

Over the past year we have worked with researchers in Kazakhstan to repatriate *Malus sieversii* collected by USDA and University researchers. Gayle Volk and Herb Aldwinkle are key advisors to their research group and support this effort as well. So far we have provided 150 accessions and will continue to support their effort to reclaim their germplasm.

PGRU Report to Apple CGC

Ben Gutierrez
John Keeton
Dawn Dellefave
Gan-Yuan Zhong



USDA

ARS

Operations

John Keeton coordinates all field activities for PGRU (clonal and vegetable)

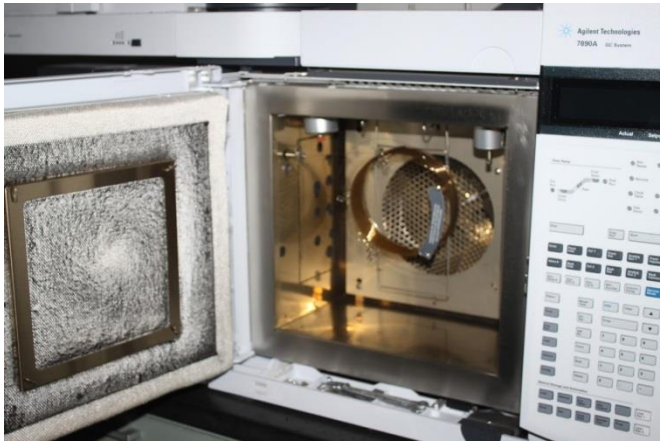
Maintenance will continue under social distancing guidelines

New collection: Industrial Hemp!

Vacancies
- Clonal Curator position (vice Chao)
- Molecular Biologist (vice Schwaninger)

2019 Interns

Operations



Full operational capacity restored
No PGRU germplasm permanently lost

New Accessions

Malus chitralensis, Pakistan -- 4 accessions

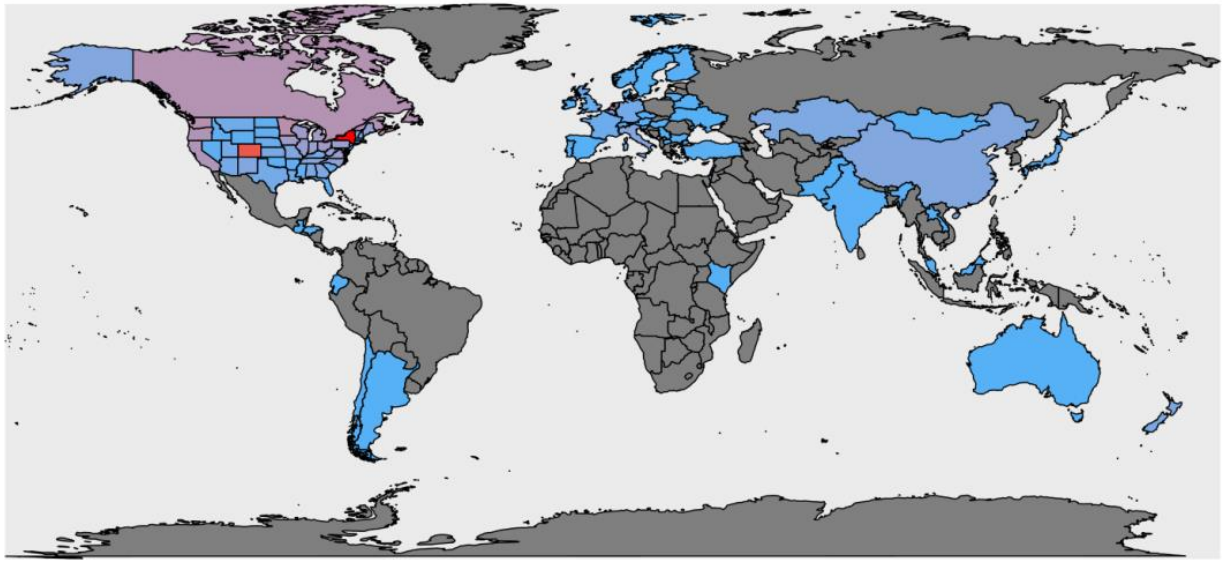
Malus crescimannoi, Italy -- 1 accession

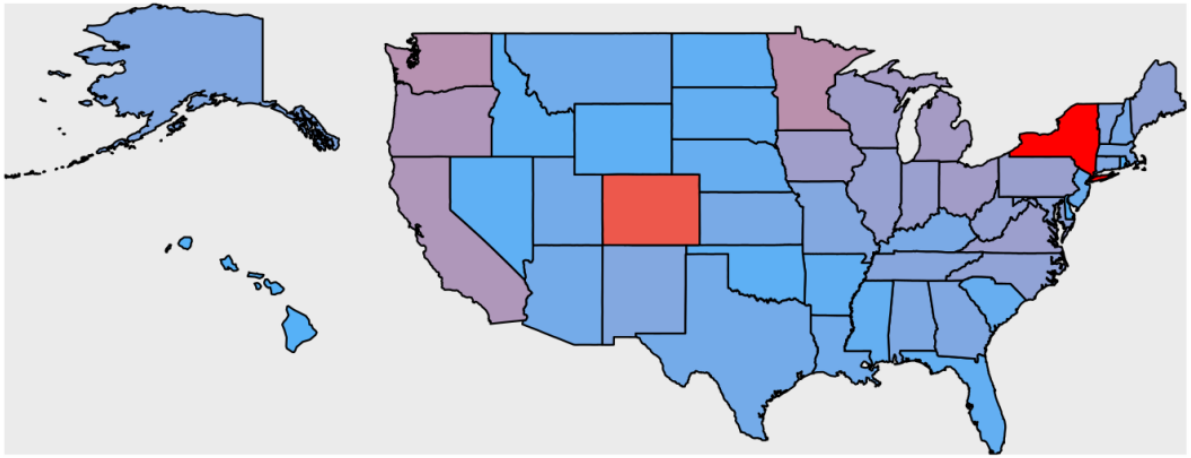
Malus sylvestris, Italy -- 1 accession

11 accessions from High Plains Arboretum in High Plains, WY. Crabapples and wild species

http://www.cwrdiversity.org/project

Impact Statement





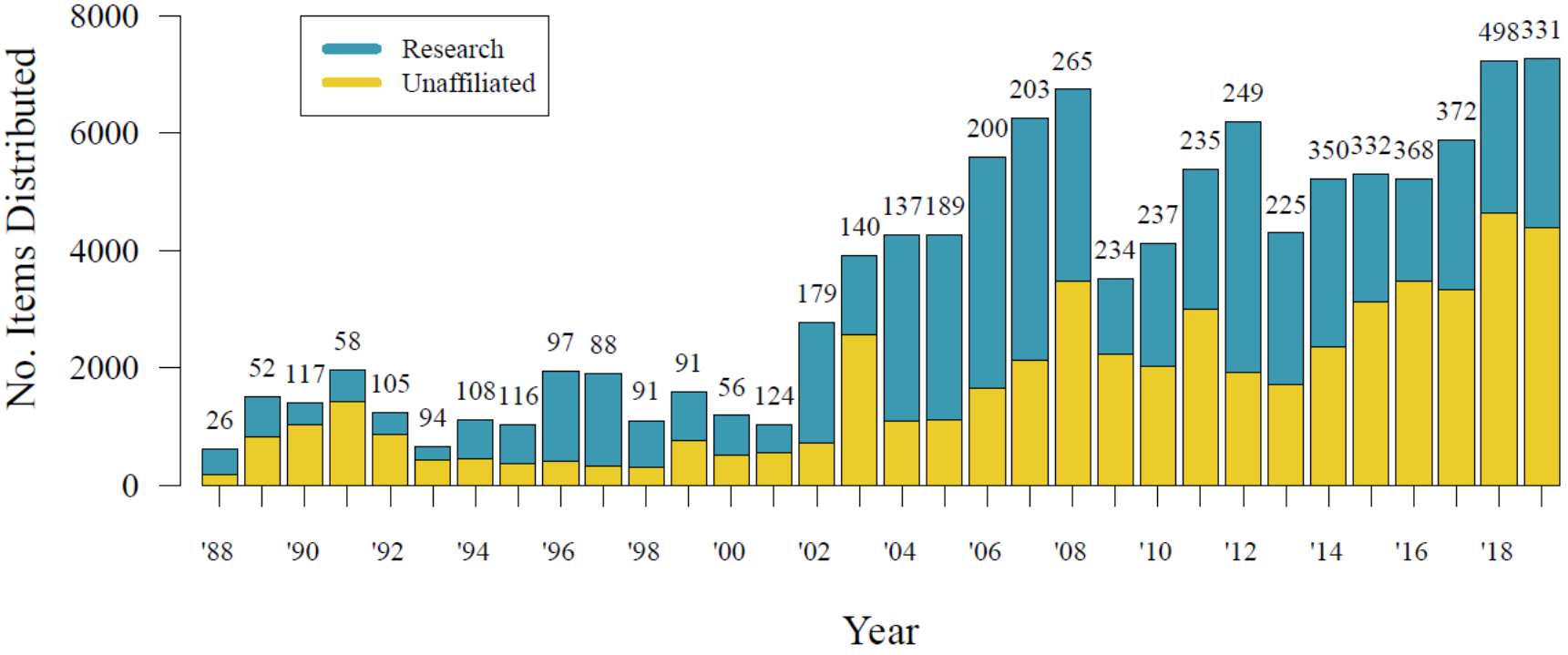
Draft provides overview of PGRU distribution

Emphasis on research and breeding effort

How has the Apple Collection impacted your research and breeding efforts?

Please provide specific details

Distribution



Number of requests and number of items increase over time

Number of completed requests decreased in 2019, but number of items distributed was the same in 2018. About 800 rejected in 2019

Proportion of unaffiliated (non-research/non-commercial) is increasing

Distribution

Increasing number of ‘COVID-19’ germplasm requests.

~200 for our site, most include multiple crops and sites

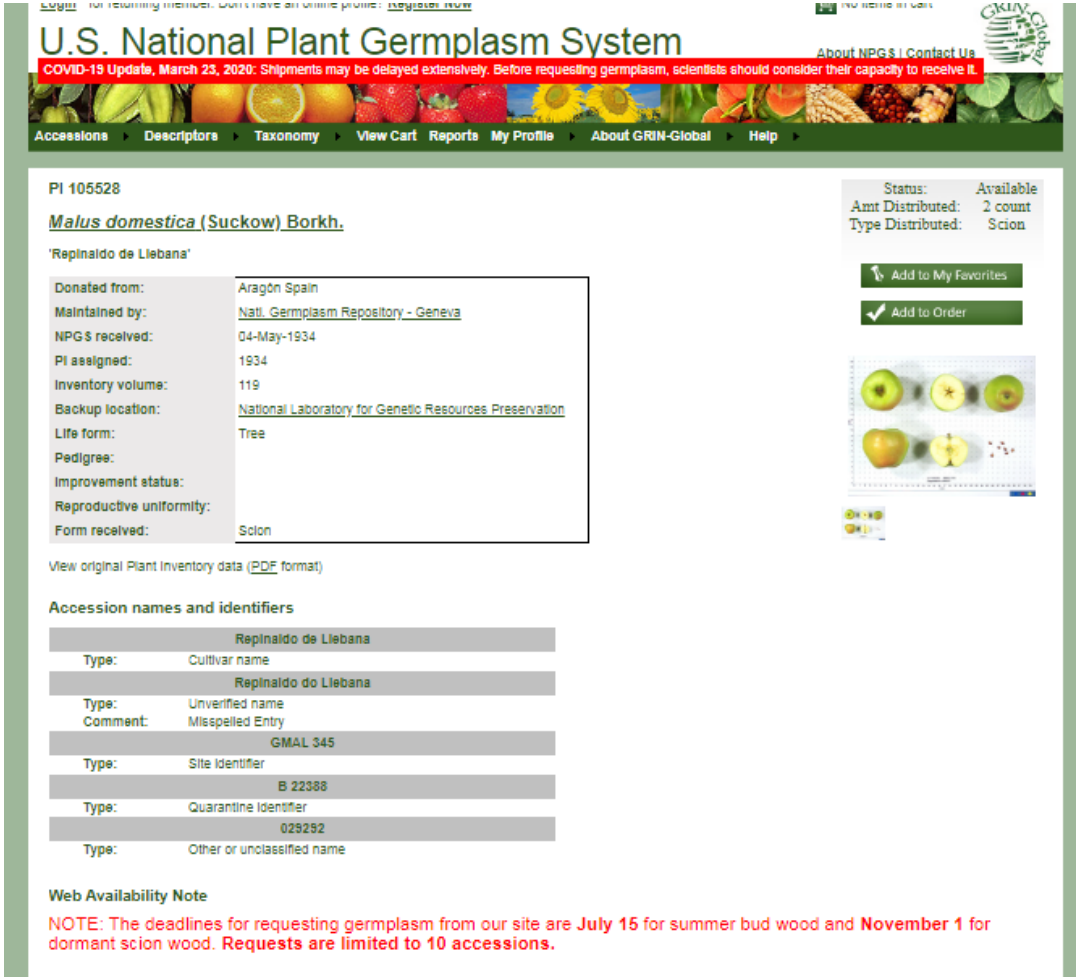
Largest request was for 3,071 items (9,099 total)

Intended use of material:
Education: Class instruction
Research use notes:
I am requesting these for my student to learn to eat healthy and learn about fruit and vegetables

Please consider providing the NPGS with publication information involving accessions used in your project. This information allows the NPGS to better manage its collections and provide data that make NPGS germplasm more valuable to researchers.
Items:
1 PI 644727 - NE9 - Solanum lycopersicum
2 PI 689687 - NC7 - Amaranthus hybridus
3 DVIT 1 - DAV - Vitis hybr.
4 CIav 1480 - NSGC - Avena sativa
5 PI 589291 - GEN - Malus domestica
6 PI 629110 - S9 - Citrullus lanatus
7 DFIC 26 - DAV - Ficus carica
8 DVIT 908 - DAV - Vitis vinifera subsp. vinifera
9 PI 606445 - COR - Rubus idaeus subsp. idaeus

Order Received: 4/8/2020 8:51:26 PM

Distribution Policy Updates



U.S. National Plant Germplasm System

COVID-19 Update, March 23, 2020: Shipments may be delayed extensively. Before requesting germplasm, scientists should consider their capacity to receive it.

About NPGS | Contact Us

Accessions | Descriptors | Taxonomy | View Cart | Reports | My Profile | About GRIN-Global | Help

PI 105528

Malus domestica (Suckow) Borkh.

'Reinaldo de Liebana'

Donated from:	Aragón Spain
Maintained by:	Natl. Germplasm Repository - Geneva
NPGS received:	04-May-1934
PI assigned:	1934
Inventory volume:	119
Backup location:	National Laboratory for Genetic Resources Preservation
Life form:	Tree
Pedigree:	
Improvement status:	
Reproductive uniformity:	
Form received:	Scion

Status: Available
Amt Distributed: 2 count
Type Distributed: Scion

Add to My Favorites

Add to Order

View original Plant Inventory data (PDF format)

Accession names and identifiers

Reinaldo de Liebana	
Type:	Cultivar name
Reinaldo do Liebana	
Type:	Unverified name
Comment:	Misspelled Entry
GMAL 345	
Type:	Site Identifier
B 22388	
Type:	Quarantine Identifier
029292	
Type:	Other or unclassified name

Web Availability Note

NOTE: The deadlines for requesting germplasm from our site are **July 15** for summer bud wood and **November 1** for dormant scion wood. **Requests are limited to 10 accessions.**

- Deadlines
  - July 15 and Nov. 1
- New 10 accession limit
- Online Request Submission
- Selectivity
  - No more grafting demos
- Top commercial accessions
  - Unavailable for request
  - Research exemption
- Non-research requests

Distribution: Top Cultivars

Accession	Species	Cultivar	Times Shipped
PI 588853	*M. domestica*	'Cox's Orange Pippin'	391
PI 588785	*M. domestica*	'Esopus Spitzenburg'	338
PI 589654	*M. domestica*	'Ashmead's Kernel'	327
PI 589892	*M. domestica*	'Golden Russet'	321
PI 588971	*M. domestica*	'Roxbury Russet'	310
PI 588943	*M. domestica*	'Liberty'	300
PI 589596	*M. domestica*	'Calville Blanc'	298
PI 613818	*M. domestica*	'Wickson'	280
PI 588791	*M. domestica*	'Grimes Golden'	269
PI 588872	*M. domestica*	'Northern Spy'	269
PI 588803	*M. domestica*	'Chestnut Crab'	265
…	…	…	…

- Top cultivars distributed and top requested
- 'Unavailability' status restricts request from GRIN
- Still available for research
  - Email PGRU

Distribution: Non-Research Request Letter

Thanks for your interest in our unique plants! We oversee the collection of tart cherries, grapes, and apples as part of the National Plant Germplasm System (NPGS).

Unfortunately, we cannot fulfill your request at this time. NPGS is a cooperative research organization designed to serve scientific research-oriented and educational-related objectives of State, Federal or Corporate entities. It is not our policy to provide plants for personal use or educational activities that can be accomplished using commercially available plants. Please follow these links for a short video (youtu.be/uHOclGNELuw) and more information on our site www.ars.usda.gov/northeast-area/geneva-ny/plant-genetic-resources-unit-pgru/.
To find suitable plants, we recommend an internet search for scions or contact your local nurseries. Plant Information Online (https://plantinfo.umn.edu/) is a resource to discover nurseries in North America with specific cultivars.

If you feel you received this in error, please provide additional information on your intended use and why commercially available cultivars could not meet your objectives.

If you have requested multiple crops, you may receive separate responses from each location.

We appreciate your understanding.

Best,

USDA-ARS Plant Genetic Resources Unit

Distribution: Research Requests

We strongly encourage researchers to notify us of their intended use of the collection

If requesting fruit, please notify us well in advance so we can arrange with our staff and coordinate with other requestors.

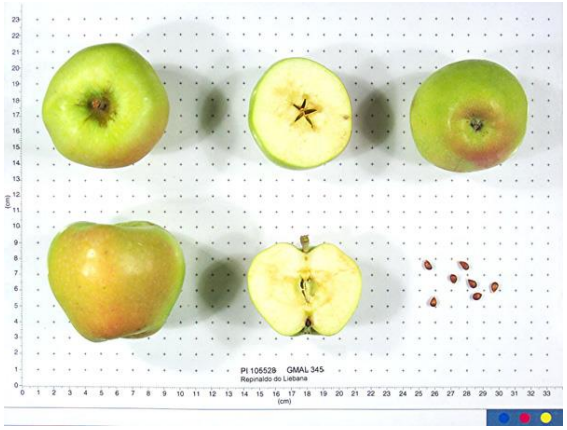
We're also discouraging researchers from collecting large scion orders. If you need support, let our team serve you!

Updates to GRIN Accession Data

Accession Name	'Repinaldo do Liebana
Plant Inventory (PI)	PI 105528
GMAL	
Quarantine (Q)	
Suggested change(s)	Change accession name to ‘Repinaldo de Liebana’
Justification	Misspelled accession name. The correct spelling for ‘Repinaldo de Liebana’ ('PI 105528’) is with ‘de’ between the names, not ‘do’. See this reference (page 18, left column) for the original spelling when it was introduced: https://www.ars-grin.gov/npgs/pi_books/scans/pi119.pdf
Requested by	Greg Peck <gmp32@cornell.edu>
Date requested	

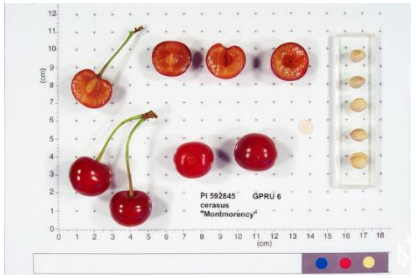
Accession names and identifiers

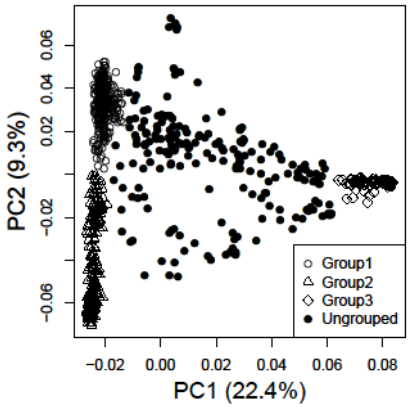
	Repinaldo de Liebana
Type:	Cultivar name
	Repinaldo do Liebana
Type:	Unverified name
Comment:	Misspelled Entry
	GMAL 345
Type:	Site identifier

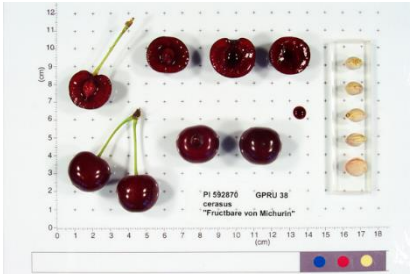


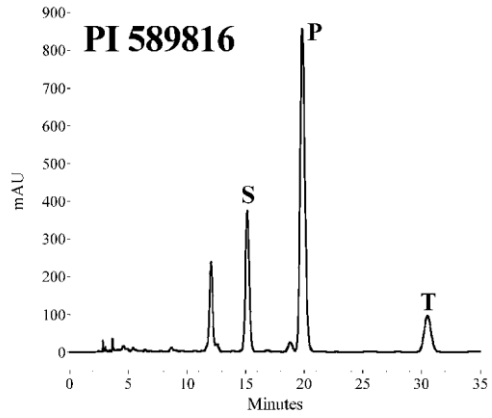
Send us your corrections!

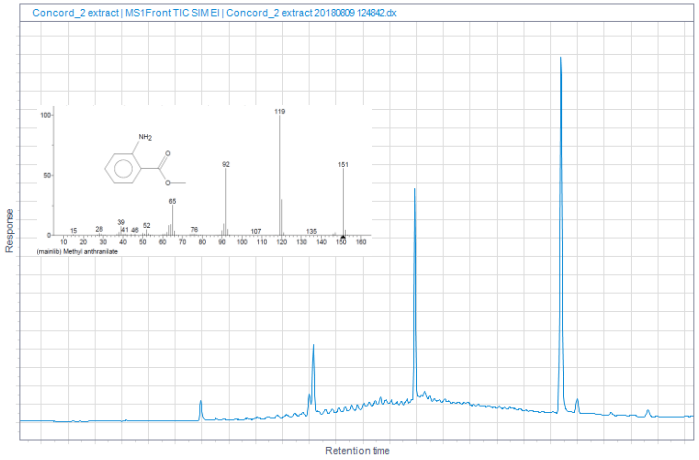
Characterization

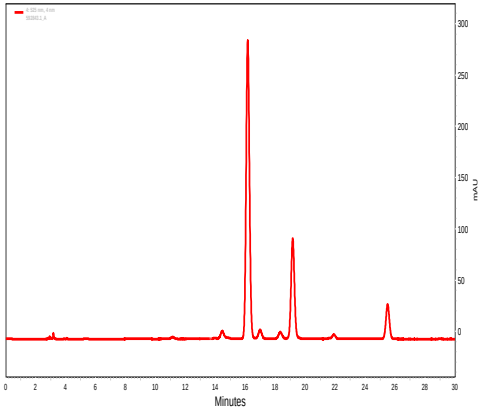












Descriptor Data

Over 134,000 data points for 106 traits.

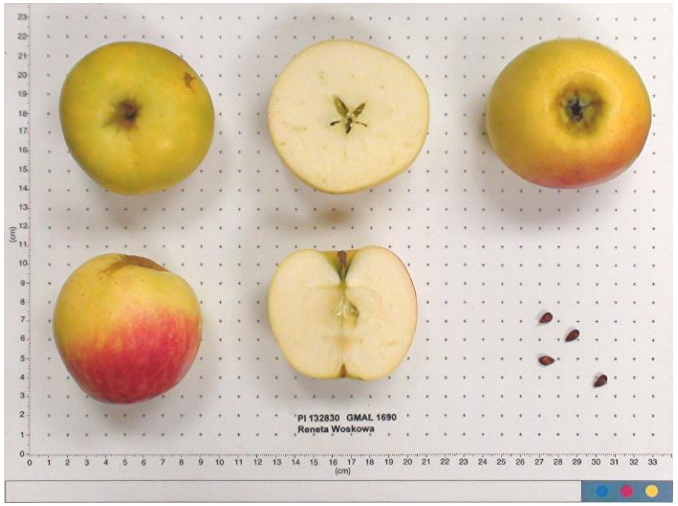
- Collected over 30+ years by PGRU

GRIN-Global could also house your data!

- Public data storage part of scientific standards for publications
- CGC Germplasm Evaluation Proposals

Help us improve accession data and narratives!

‘Fall Russet’
“Fruit: size medium, 65mm; skin russet; shape round-oblate; flesh semifirm, cream colored; flavor subacid; eating quality good; harvest season late September, 2 weeks before Delicious. Tree: strongly biennial. Russet, good quality.” – Roger Way



‘Reneta Woskowa’

“yes”

We have 6,080 accessions (active and inactive) in GRIN. 3,988 have narratives of varying quality

Help us improve accession data and narratives!

Around the World in Rare and Beautiful Apples

From the sweet to the offbeat.

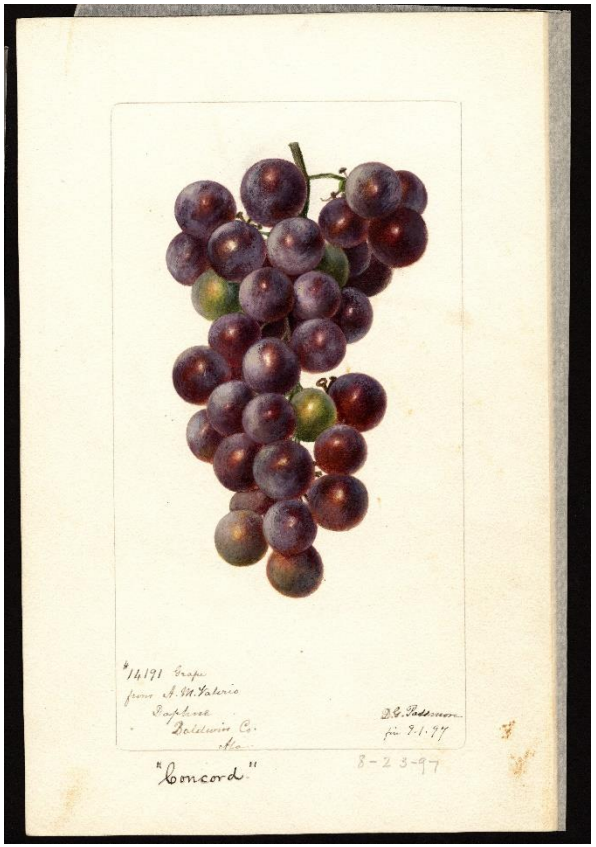
BY ANNE EWBANK • JANUARY 6, 2020

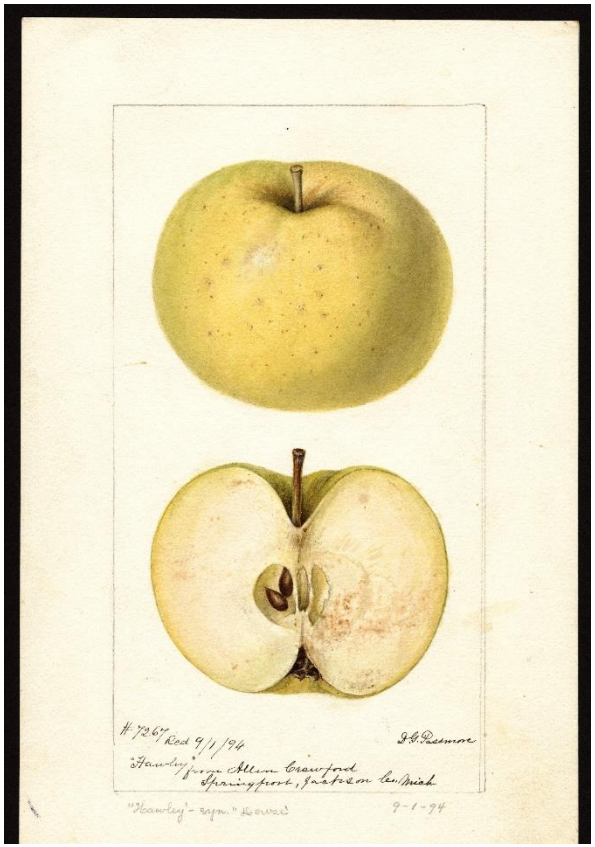
The Pink Pearl apple, seen from the top. COURTESY OF WILLIAM MULLAN

Mullan holds the humble Bean apple, which the USDA has described as "worthless." ANNE EWBANK FOR GASTRO OBSCURA

"Please consider providing the NPGS with publication information involving accessions used in your project. This information allows the NPGS to better manage its collections and provide data that make NPGS germplasm more valuable to researchers."

https://www.atlasobscura.com/articles/unusual-apples





USDA-PGRU Tour of the Grape, Cherry, and Apple collections

Saturday, Sept. 19, 2020