Welcome to the NPGS Crop Germplasm Committee Chairs Virtual Meeting

December 3, 2015

The meeting will begin at 1:30 pm EST

Speedy Introductions

State your name and employer/location
as I call the roll in alphabetical order of CGCs
(Alfalfa to Woody Landscape)

CGC Chair Best Practices

- Submit minutes after CGC meetings, or ensure secretary does
- Ensure your membership rosters are up to date
- Notify NGRL when Chair rotates to a new member
- Notify NGRL as far in advance as possible of meeting dates
- Spearhead the preparation of Crop Vulnerabilty Statements
- Consider virtual technologies (such as this one) if having a difficult time arranging well attended in person meetings
- Consider joint meetings with other CGCs based on natural alignments and/or meeting locations

We are grateful to you and your committees for supporting the U.S. National Plant Germplasm System!

Thank You

National Laboratory for Genetic Resources Preservation

1111 South Mason St
Fort Collins, CO

Plant and Animal Genetic Resources Preservation Unit

Safety back up of our national collection of genetic resources through diligent stewardship, research and communication

Harvey Blackburn, Acting Research Leader
Stephanie Greene, Seed Curator
Maria Jenderek, Clonal Curator

Types of Storage at NLGRP

Cryo Storage (-196 °C)

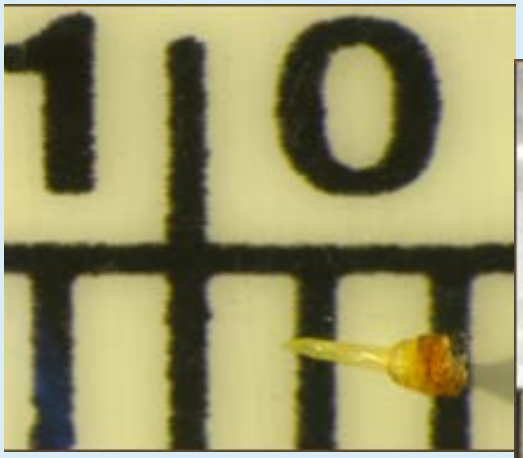
Conventional Cold Storage (-18°C)

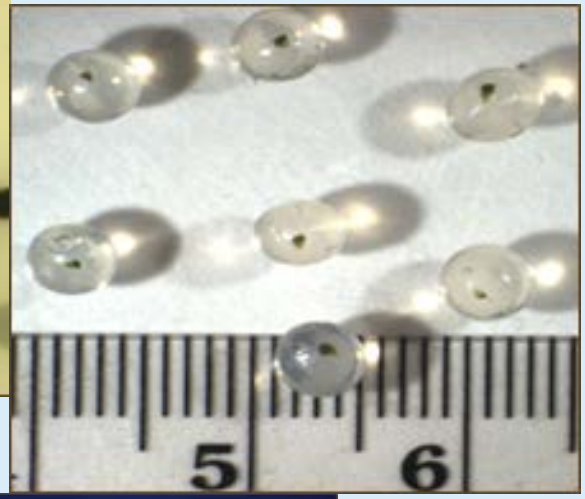
Base Collection

- Seed received and logged into GRIN
- Equilibrated for 3-4 weeks at 5C/25%RH
- Tested for viability
- Sealed in aluminum bags to control RH
- Stored in -18^{o}C cold vaults or LN_2
- Monitor testing

Clonal Cryopreservation

Stored as meristem shoots or dormant buds



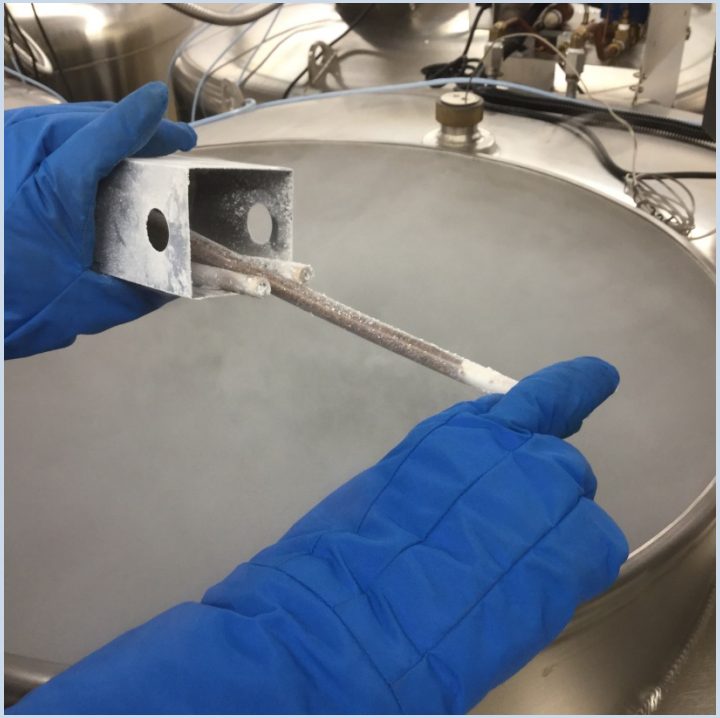


Safety duplication of NPGS collection

82% - seed collection

15% - clonal collection

3% - NPGS accessions unique to NLGRP



Safety duplication of non-NPGS germplasm

- 7756 PVP voucher samples
- 2459 *Journal of Plant Registration* voucher samples
- 300,000 accessions “black-box” – CGIAR, Seed Savers Exchange, etc.
- Rare and Endangered species
- USFS, Indian Tribes (*Fraxinus*), special collections (i.e. McClintock’s maize lines)

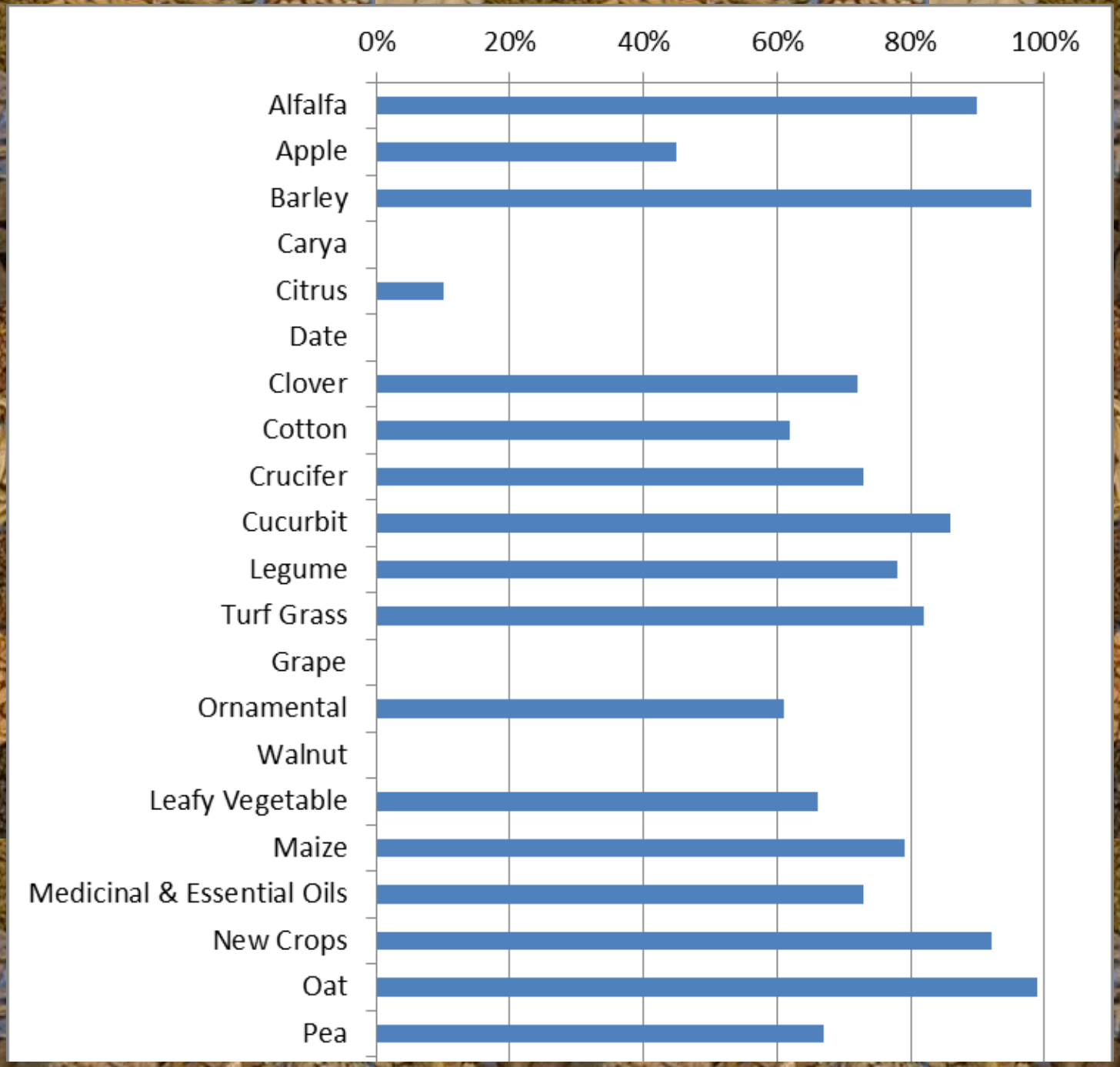
2015 Activities

- Staffing turnover- We had five additional vacancies, bringing total to 9; but have since filled 5. Rest are in HR pipeline.
- Received 11,689 seed packets from NPGS active sites. Over 58% of the incoming seed from NPGS sites had over 85% germination and we expect them to have maximum longevity in storage. Eighteen percent had less than 65% viability; sites were provided feedback.
- Assessed viability, packaged and stored 8285 seed packets in conventional storage and 982 packets in cryo storage. 362 *in vitro* samples and 193 shoot meristem samples were processed and stored in cryo.

- Reprioritized monitor testing to focus on short lived species that have not been tested in 10-20 years.

- Developed prototype software application that prioritizes monitor testing based on estimates of species longevity and last viability test date.

- Sent out 18,000 accessions to the Svalbard Seed Vault in Norway. This was the largest single shipment from any country, and generated positive publicity for the US and Crop Trust activities. Approximately 20% of NPGS collection is at Svalbard


0%
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80%
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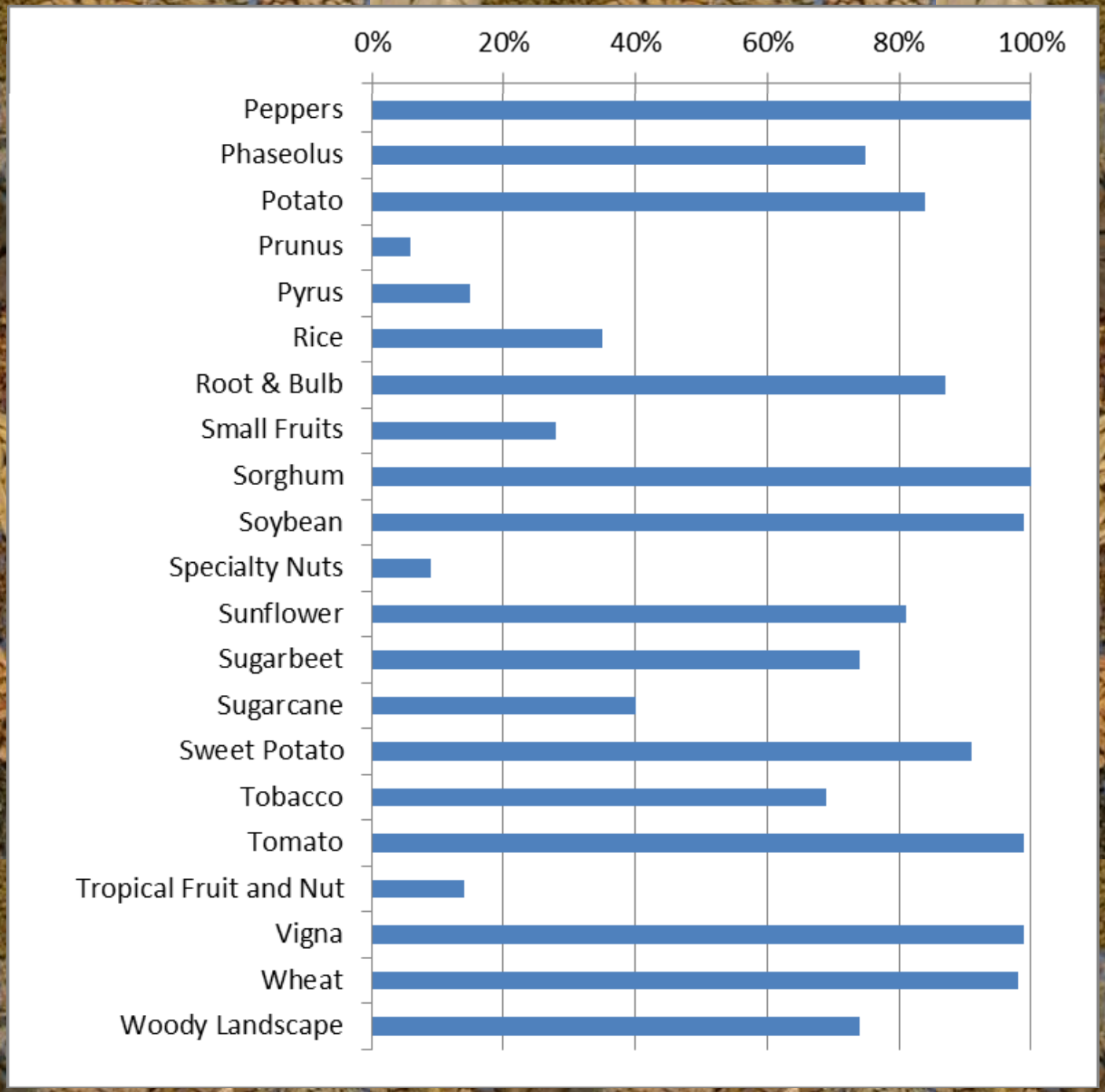
Alfalfa
Apple
Barley
Carya
Citrus
Date
Clover
Cotton
Crucifer
Cucurbit
Legume
Turf Grass
Grape
Ornamental
Walnut
Leafy Vegetable
Maize
Medicinal & Essential Oils
New Crops
Oat
Pea


0%
20%
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80%
100%
Peppers
Phaseolus
Potato
Prunus
Pyrus
Rice
Root & Bulb
Small Fruits
Sorghum
Soybean
Specialty Nuts
Sunflower
Sugarbeet
Sugarcane
Sweet Potato
Tobacco
Tomato
Tropical Fruit and Nut
Vigna
Wheat
Woody Landscape

Summary of security backup by CGC crops

- **Cryopreservation of clonal crops is limited due to resource constraints and need to develop protocols**
- **Most seed crops are adequately backed up. What is not backed up are samples queued for regeneration or having small seed quantities and low regen. priority**
- **Recommend active sites send critical backup samples**

Questions?

The NPGS Plant Exploration/Exchange Program

- fills gaps in the NPGS
- proposals accepted yearly by NGRL- PEO for explorations the next fiscal year
- Next due date: July 22, 2016
- guidelines distributed to CGC Chairs
- separate guidelines for explorations and exchanges
- CGCs and curators must endorse proposals

For more information, contact:
Karen Williams
Karen.Williams@ars.usda.gov
301-504-5421

2015 NPGS Plant Explorations

Woody ornamentals	Armenia
Woody ornamentals	Georgia
Beta spp.	United States (CA)
Helianthus spp.	United States (AZ, NM)
Malus angustifolia	United States (AL, AR, MS)
Solanum jamesii & fendleri	United States (AZ)
Cotinus obovatus	United States (AR, MO, OK)
Gymnocladus dioicus	United States (AR, KS, MO, OK)
Panicum virgatum	United States (CT, MA, MN, NH, RI, VT)

2016 Plant Explorations

Completed\scheduled

Small fruits	Vietnam
Daucus spp.	Spain
Phaseolus polystachios	United States (OH)
Helianthus spp.	United States (AL, FL)
Ipomoea spp.	United States (FL, GA, SC)
Fraxinus quadrangulata	United States (OH, KY, IN, TN)
Herbaceous ornamentals	United States (CA)

Proposals

6 domestic proposals

Access and Benefit Sharing for International Explorations

- prior informed consent (PIC) obtained from national authority
- includes agreement on the sharing of benefits
- acceptable benefits are “in-kind” (training, equipment purchase, increase projects, etc.)
- PEO obtains PIC
- SMTA provides terms for some explorations

National Plant Germplasm System

Browse By Taxonomy

Restrict to Genus that exactly match :

Restrict to Species that exactly match :

Exclude Empty Items

Group By: Family Genus Species

Order By: Name Accession Count

Go

National Plant Germplasm System

Advanced Query of GRIN TAXONOMY Species Data

Any or all fields can be searched. Wild cards (*) are accepted. Multiple values could be selected from list boxes by using shift or control key.

Genus or species name: (e.g. *Arachis* or *Zea Mays* [without author])

Family(ies):
- ALL FAMILIES
- all pteridophytes
- all gymnosperms
- all angiosperms
- plant pathogens
- Abaminaceae

Common name: (e.g. maize [no diacritics])

Native distribution: Continent: ALL CONTINENTS Region: ALL REGIONS

Country(ies):
- ALL COUNTRIES
- Afghanistan
- Albania
- Algeria
- American Samoa

State/Province: (e.g. Alabama)

Non-native distribution: (entry as **Or** **And** criterion) (e.g. cultivated, naturalized, Africa, United States, Macaronesia)

Restrict to only accepted names

Restrict to names with germplasm in GRIN

Search

National Plant Germplasm System

Simple Query of GRIN TAXONOMY Species Data

Enter search criterion. Wild cards (*) are accepted: Search

You can search for any one of these identifiers:

- **Scientific name** (e.g. *Triticum aestivum* [without author]).
- **Common name** (e.g. wheat [no diacritics].
- **Genus name** (e.g. *Triticum*).
- **Family name** (e.g. Poaceae).
- **Species nomen number** (e.g. 40544).
- **Country in species native range** (e.g. Zaire).

GRIN-Taxonomy Crop Wild Relative (CWR) Inventory

1. PEO Project initiated in 2008 to assess CWR germplasm needs for NPGS
2. Identify CWR by "gene pool" status
3. Initial work prioritized by economic value of crops
4. Supporting data gleaned from multiple sources
5. Sought external review of treatment

Genetic Relative Classification Criteria

Primary – Taxa that cross readily with the crop (or can be predicted to do so based on their taxonomic relationships), yielding (or being expected to yield) fertile hybrids with good chromosome pairing, making gene transfer through hybridization simple.

Genetic Relative Classification Criteria

Secondary – Taxa that will successfully cross with the crop (or can be predicted to do so based on their taxonomic relationships), but yield (or would be expected to yield) partially or mostly sterile hybrids with poor chromosome pairing, making gene transfer through hybridization difficult.

Genetic Relative Classification Criteria

Tertiary – Taxa that can be crossed with the crop (or can be predicted to do so based on their taxonomic relationships), but hybrids are (or are expected to be) lethal or completely sterile. Special breeding techniques, some yet to be developed, are required for gene transfer.

Genetic Relative Classification Criteria

Graftstock – Taxa used as rootstocks for grafting scions of a crop, or used as genetic resources in the breeding of such rootstocks.

Data Elements

1. Taxonomic or phylogenetic relationship of crop and CWR
2. Genetic relative status of CWR
3. Geographical distribution of CWR
4. Passport data of crop and CWR accessions

Crop Genera Already Treated (165 crops)

Cereal: *Avena*, *Hordeum*, *Oryza*, *Secale*, *Sorghum*, *Triticum*, *Zea*, *Zizania*
Fiber: *Gossypium*, *Linum*
Forage: *Medicago*, *Trifolium*
Fruit/Nut: *Actinidia*, *Ananas*, *Artocarpus*, *Carica*, *Carya*, *Castanea*, *Citrus*, *Citrullus*, *Corylus*, *Eriobotrya*, *Fragaria*, *Juglans*, *Macadamia*, *Malus*, *Mangifera*, *Musa*, *Olea*, *Persea*, *Phoenix*, *Pistacia*, *Prunus*, *Pyrus*, *Ribes*, *Rubus*, *Solanum*, *Theobroma*, *Vaccinium*, *Vitis*
Oilseed: *Brassica*, *Carthamus*, *Crambe*, *Helianthus*, *Olea*
Pseudocereal: *Chenopodium*
Pulse: *Arachis*, *Cajanus*, *Cicer*, *Glycine*, *Lens*, *Lupinus*
Vegetable: *Allium*, *Alocasia*, *Asparagus*, *Beta*, *Brassica*, *Capsicum*, *Cichorium*, *Colocasia*, *Cucumis*, *Cucurbita*, *Cynara*, *Daucus*, *Dioscorea*, *Eruca*, *Ipomoea*, *Lactuca*, *Pachyrhizus*, *Pastinaca*, *Phaseolus*, *Pisum*, *Raphanus*, *Rheum*, *Sechium*, *Solanum*, *Spinacia*, *Vicia*, *Vigna*
Other: *Coffea*, *Humulus*, *Manihot*, *Mentha*, *Nicotiana*, *Saccharum*, *Sinapis*

Query Crop Relatives in GRIN

Any or all fields can be searched. Wild cards (*) are accepted. Multiple values could be selected from list boxes by using shift or control key.

Crop:
- ALL
- AHIPA - Pachyrhizus ahipa
- AJI - Capsicum baccatum var. pendulum
- ALFALFA - Medicago sativa subsp. sativa
- ALMOND - Prunus dulcis
- APPLE - Malus domestica

Genus name: (e.g. Oryza [without author])

Note: Only returns CWR in that genus. Select by crop to return all CWR of its crops.

Genetic relative status: ☑ primary ☑ secondary ☑ tertiary ☑ graftstock

Family(ies):
- ALL FAMILIES
- all pteridophytes
- all gymnosperms
- all angiosperms
- Abaminaceae
- Abietaceae

Native distribution:

Continent: ALL CONTINENTS Region: ALL REGIONS

Country(ies):
- ALL COUNTRIES
- Afghanistan
- Albania
- Algeria
- American Samoa

State/Province: (e.g. Alabama)

☐ **Include non-native distribution**

Restrict to crops maintained at these NPGS repositories
- ALL
- Arctic and Subarctic Plant Gene Bank - PALM
- C.M. Rick Tomato Genetics Resource Center - TGRC
- Clover collection - CLO

☐ **Restrict to names with germplasm in GRIN**

☐ **Restrict to names without germplasm in GRIN**

Search

Crop Relatives in GRIN Taxonomy

(for the query: **family** = 'all families' & **native country** = 'all countries' & **crops** = 'alfalfa' & **genetic relative status** = 'GR1, GR2, GR3, GS' & **repositories** = 'all')

Follow links for a) **GRIN taxon reports** or b) **to view literature supporting this gene pool classification** (Place cursor over highlighted items for explanation.)

Crop: ALFALFA

(compiled by Dr. Blanca León; reviewed by Dr. Stephanie L. Greene, Geneticist/Curator, USDA/ARS, National Temperate Forage Legume Genetic Resources Unit, Prosser, Washington on 7 November 2012)

Crop taxon:

1. ***Medicago sativa* L. subsp. *sativa*** - **alfalfa**
2. ***Medicago sativa* L. subsp. *falcata* (L.) Arcang.** - **sickle alfalfa**
3. ***Medicago sativa* L. subsp. *varia* (Martyn) Arcang.** - **variegated alfalfa**

Crop wild relatives:

Primary

1. *Medicago sativa* L. subsp. *tunetana* Murb. - [Reference]
2. *Medicago sativa* L. subsp. *varia* (Martyn) Arcang. - [Reference]
3. *Medicago sativa* L. subsp. *glomerata* (Balb.) Rouy - [Reference]
4. *Medicago sativa* L. subsp. *sativa* - [Reference]
5. *Medicago sativa* L. subsp. *falcata* (L.) Arcang. var. *falcata* (L.) Doll - [Reference]
6. *Medicago sativa* L. subsp. *falcata* (L.) Arcang. var. *viscosa* (Rchb.) Posp. - [Reference]

Secondary

1. *Medicago prostrata* Jacq. - [Reference]
2. *Medicago sativa* L. subsp. *tunetana* Murb. - [Reference]
3. *Medicago sativa* L. subsp. *varia* (Martyn) Arcang. - [Reference]
4. *Medicago sativa* L. subsp. *caerulea* (Less. ex Ledeb.) Schmalh. - [Reference]
5. *Medicago sativa* L. subsp. *glomerata* (Balb.) Rouy - [Reference]
6. *Medicago sativa* L. subsp. *falcata* (L.) Arcang. var. *falcata* (L.) Doll - [Reference]
7. *Medicago sativa* L. subsp. *falcata* (L.) Arcang. var. *viscosa* (Rchb.) Posp. - [Reference]

Tertiary

1. *Medicago arborea* L. - [Reference]
2. *Medicago cancellata* M. Bieb. - [Reference]
3. *Medicago daghestanica* Rupr. ex Boiss. - [Reference]
4. *Medicago hybrida* (Pourr.) Trautv. - [Reference]
5. *Medicago marina* L. - [Reference]
6. *Medicago papillosa* Boiss. - [Reference]
7. *Medicago papillosa* Boiss. subsp. *macrocarpa* (Boiss.) Urb. - [Reference]
8. *Medicago papillosa* Boiss. subsp. *papillosa* - [Reference]
9. *Medicago pironae* Vis. - [Reference]
10. *Medicago rhodopea* Velen. - [Reference]
11. *Medicago rupestris* M. Bieb. - [Reference]
12. *Medicago ruthenica* (L.) Trautv. - [Reference]
13. *Medicago saxatilis* M. Bieb. - [Reference]

National Plant Germplasm System

Crop Relatives in GRIN

(for the query: **family** = 'all families' & **native country** = 'all countries' & **crops** = 'chickpe

Follow links for a) **GRIN taxon reports** or b) **to view literature supporting this gene pool**

Crop: CHICKPEA
(compiled by Dr. Blanca León; reviewed by Dr. Michael A. Grusak, USDA/ARS Children's Nutr
Western Regional Plant Introduction Station, Pullman, Washington on 18 June 2013)

Crop taxon:

1. ***Cicer arietinum* L.** - **chickpea**

Crop wild relatives:

Primary

1. *Cicer reticulatum* Ladiz. - [Reference]

Secondary

1. *Cicer echinospermum* P. H. Davis - [Reference]

Tertiary

1. *Cicer atlanticum* Coss. ex Maire - [Reference]
2. *Cicer bijugum* Rech. f. - [Reference]
3. *Cicer incisum* (Willd.) K. Maly - [Reference]
4. *Cicer judaicum* Boiss. - [Reference]
5. *Cicer pinnatifidum* Jaub. & Spach - [Reference]

Literature citations for crop relative gene pool assignment -...

https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomyliterature.aspx?tid=

Literature References for GRIN Taxonomy Crop Relative Gene Pool Assignment

Taxon

- Davies, A. M. R. et al. 2007. A natural infrageneric classification for *Cicer* (Leguminosae, Cicereae) (Blumea) 52:379-400. : [relative; this study complements Maesen et al. 2007 (Chickpea Breed Mgmt 2:14-45.) proposed taxonomy; *Cicer incisum* clustered with other two perennials (*C. atlanticum* and *C. canariense*) and in a group also including all annual species; affinities of *C. incisum* to *C. atlanticum* are supported by morphology, ISSR, AFLP, allozyme and RAPD data; this study recognized *C. incisum* in subgenus *Cicer* section *Chamaecicer*]
- Javadi, F. et al. 2007. Geographical diversification of the genus *Cicer* (Leguminosae: Papilionoideae) inferred from molecular phylogenetic analyses of chloroplast and nuclear DNA sequences Bot. J. Linn. Soc. 154:175-186. : [relative; this study examined one accession of *Cicer incisum*; all data analysis showed similar topology; combined data provided a strongly supported group including *C. incisum* and all annual species (*C. arietinum*, *C. reticulatum*, *C. echinospermum*, *C. judaicum*, *C. bijugum*) except *C. yamashitae*]
- Shan, F. et al. 2005. Geographical patterns of genetic variation in the world collections of wild annual *Cicer* characterized by amplified fragment length polymorphisms Theor. Appl. Genet. 110:381-391. : [relative; this study commented that although *Cicer anatolicum* is mostly considered to be the closest perennial species to the annual species, there is a need to clarify the perennial ancestor of the annual species in *Cicer* by adding additional accessions of each species included in phylogenetic studies; this study mentioned *C. incisum* as another candidate perennial species with a probable close affinity to annual *Cicer*]
- Sudupak, M. A. et al. 2002. Analysis of genetic relationships among perennial and annual *Cicer* species growing in Turkey using RAPD markers Theor. Appl. Genet. 105:1220-1228. : [relative; this study included one non-USDA accession representing this species; based on genetic similarities this species clustered close to group of annual species *C. pinnatifidum* - *C. bijugum*]

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Genetic relative status: ☑ primary ☐ secondary ☐ tertiary ☐ graftstock

Family(ies):
- Chelidoniaceae
- Chelonaceae
- Chenopodiaceae
- Chingithamnaceae
- Chionographidaceae
- Chironiaceae

Native distribution:

Continent: ALL CONTINENTS Region: ALL REGIONS

Country(ies):
- ALL COUNTRIES
- Afghanistan
- Albania
- Algeria
- American Samoa

State/Province: ALL STATES/PROVINCES

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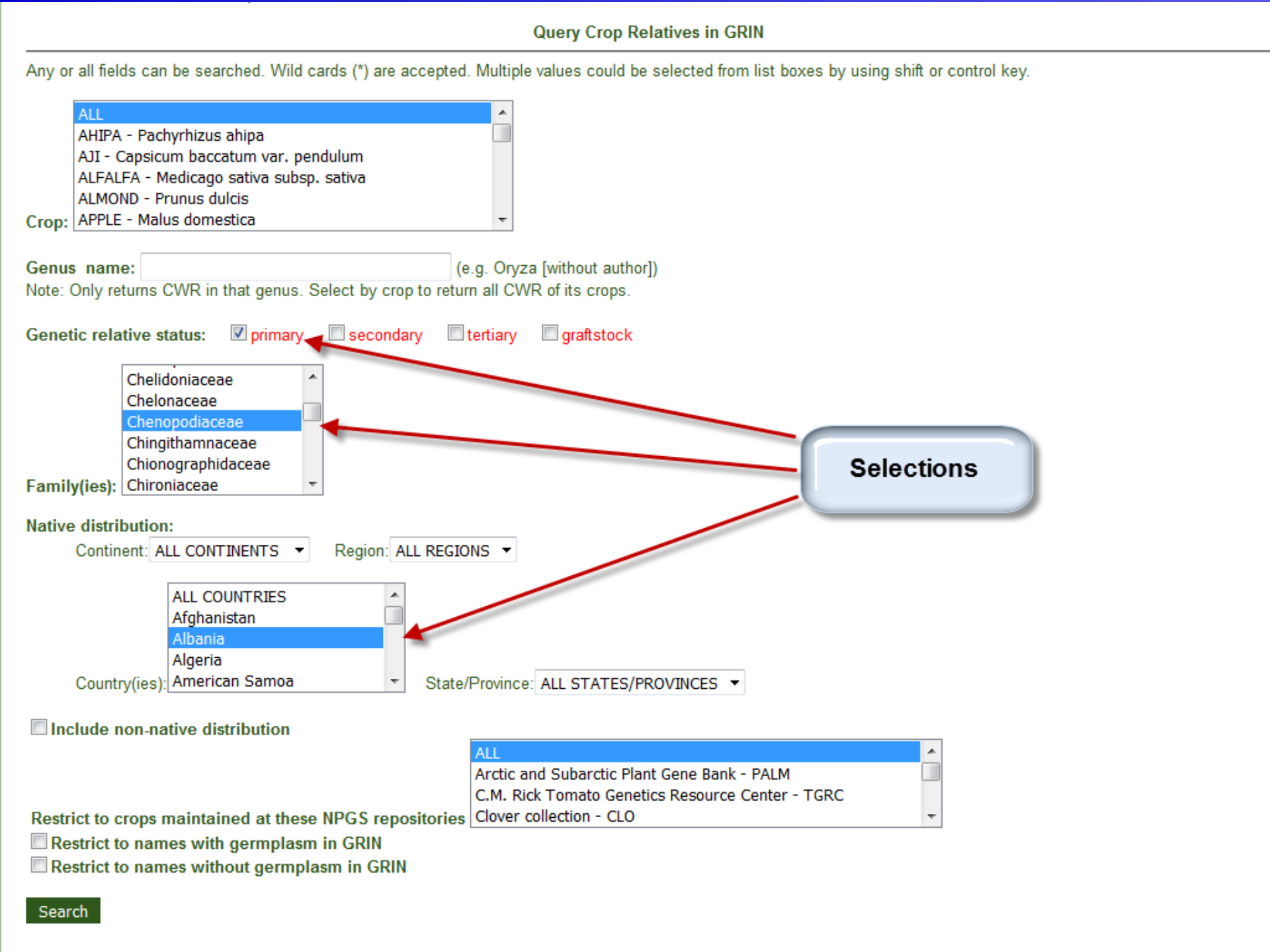


GRIN
CWR Data

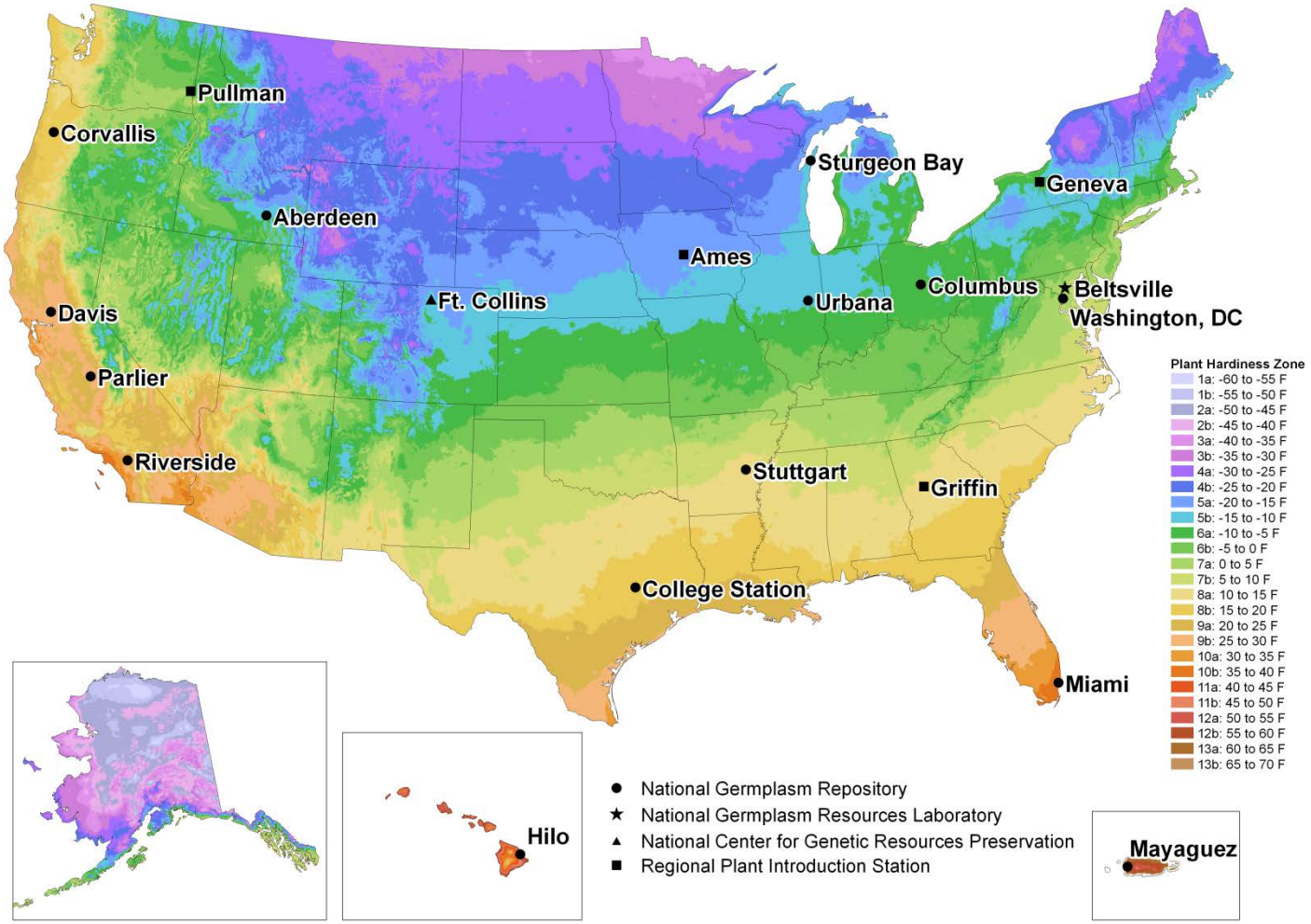
Dr. Blanca León

https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearchcwr.aspx

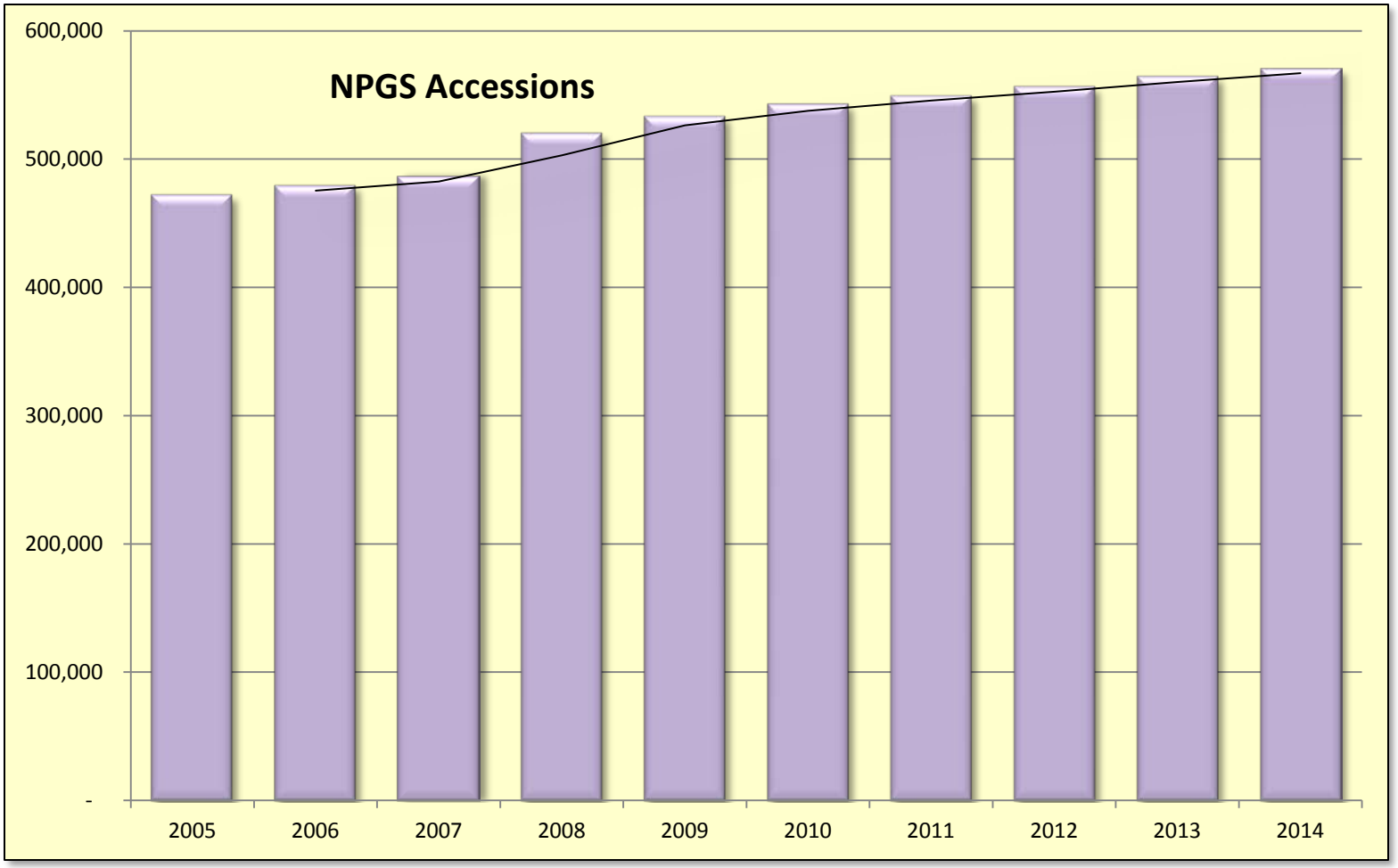
The National Plant Germplasm System: 2015 Status, Prospects, and Challenges

Peter Bretting
USDA/ARS Office of National Programs
Peter.bretting@ars.usda.gov
1.301.504.5541

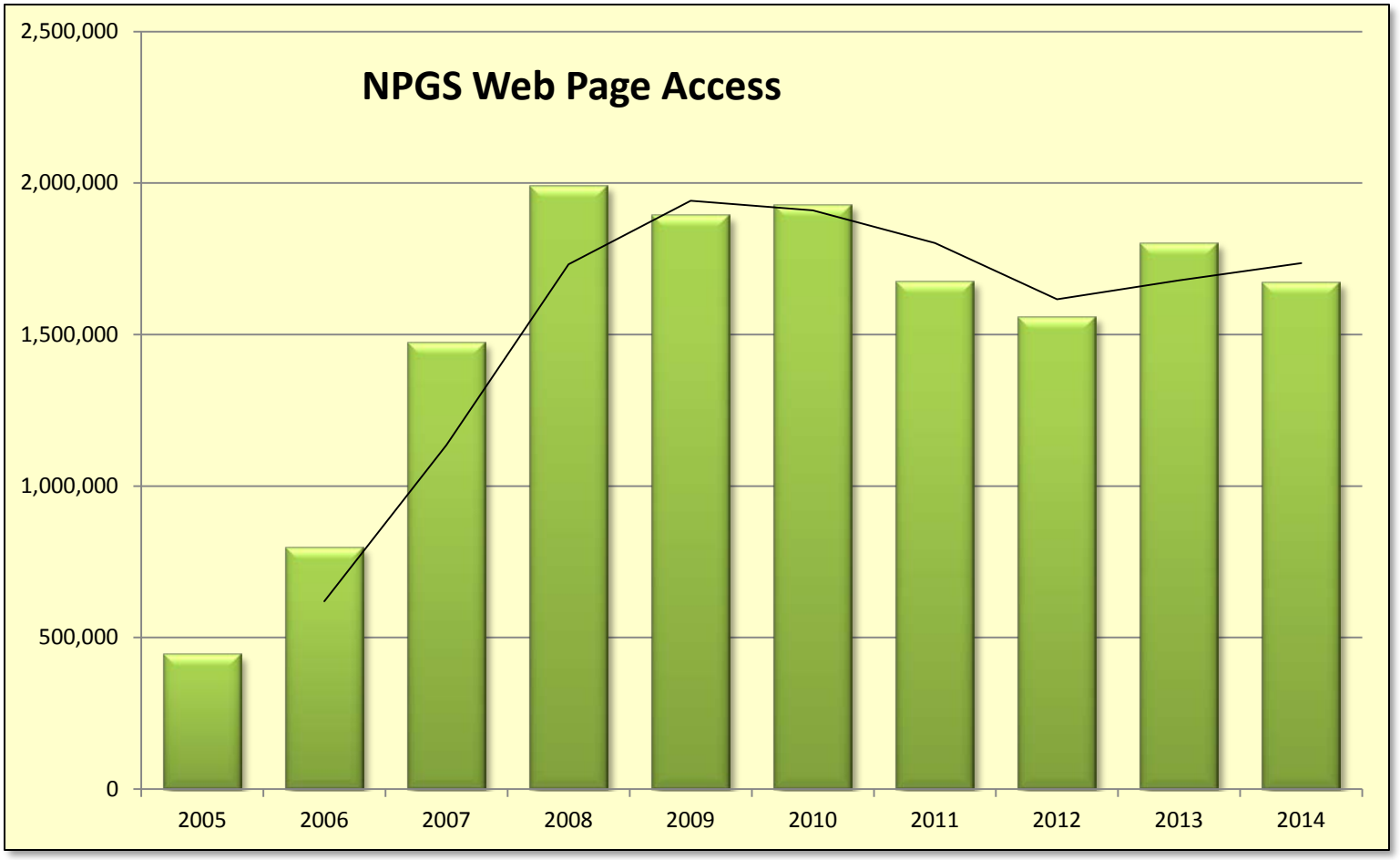
USDA National Plant Germplasm System (NPGS)



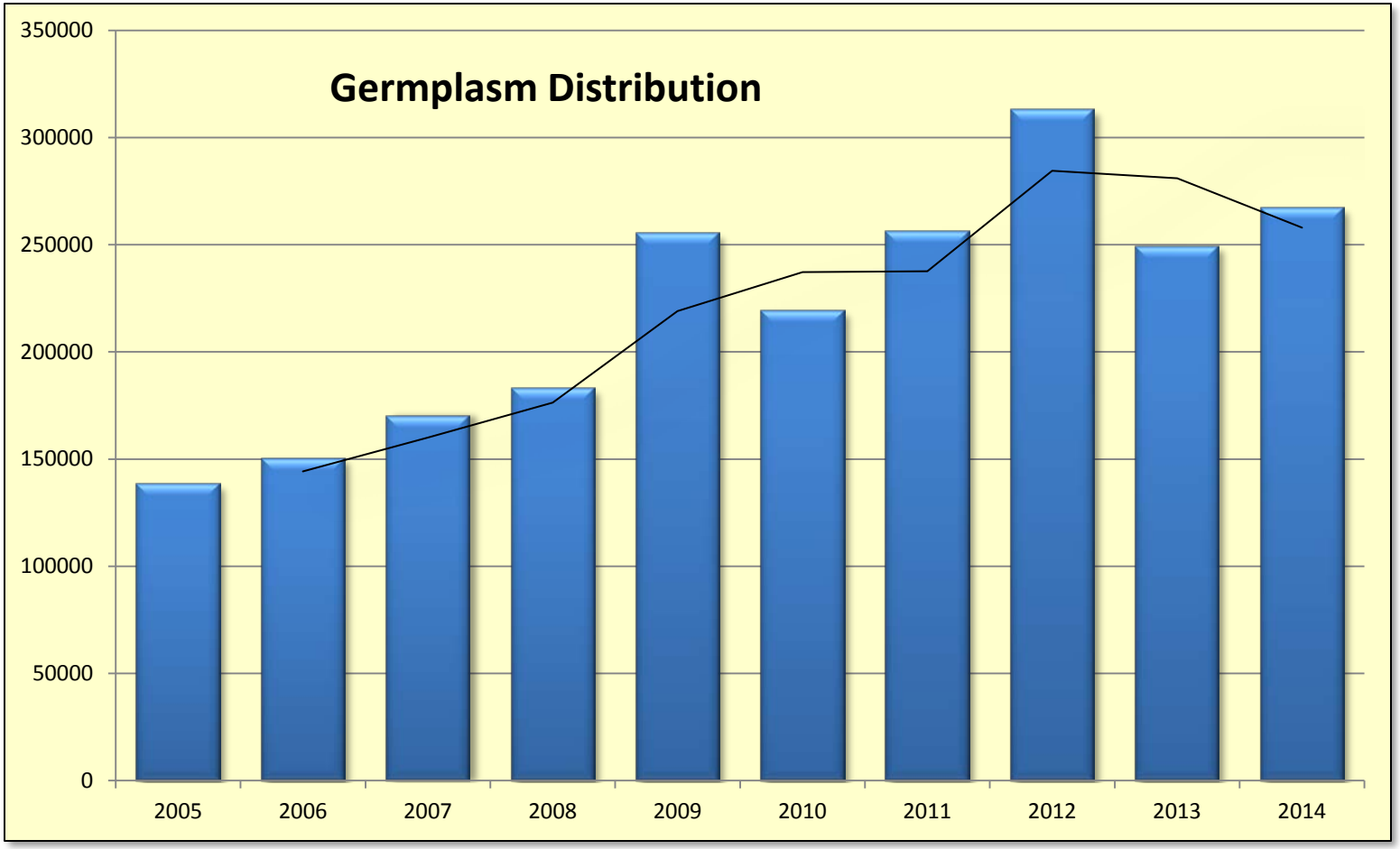
Number of NPGS Accessions 2005-2014



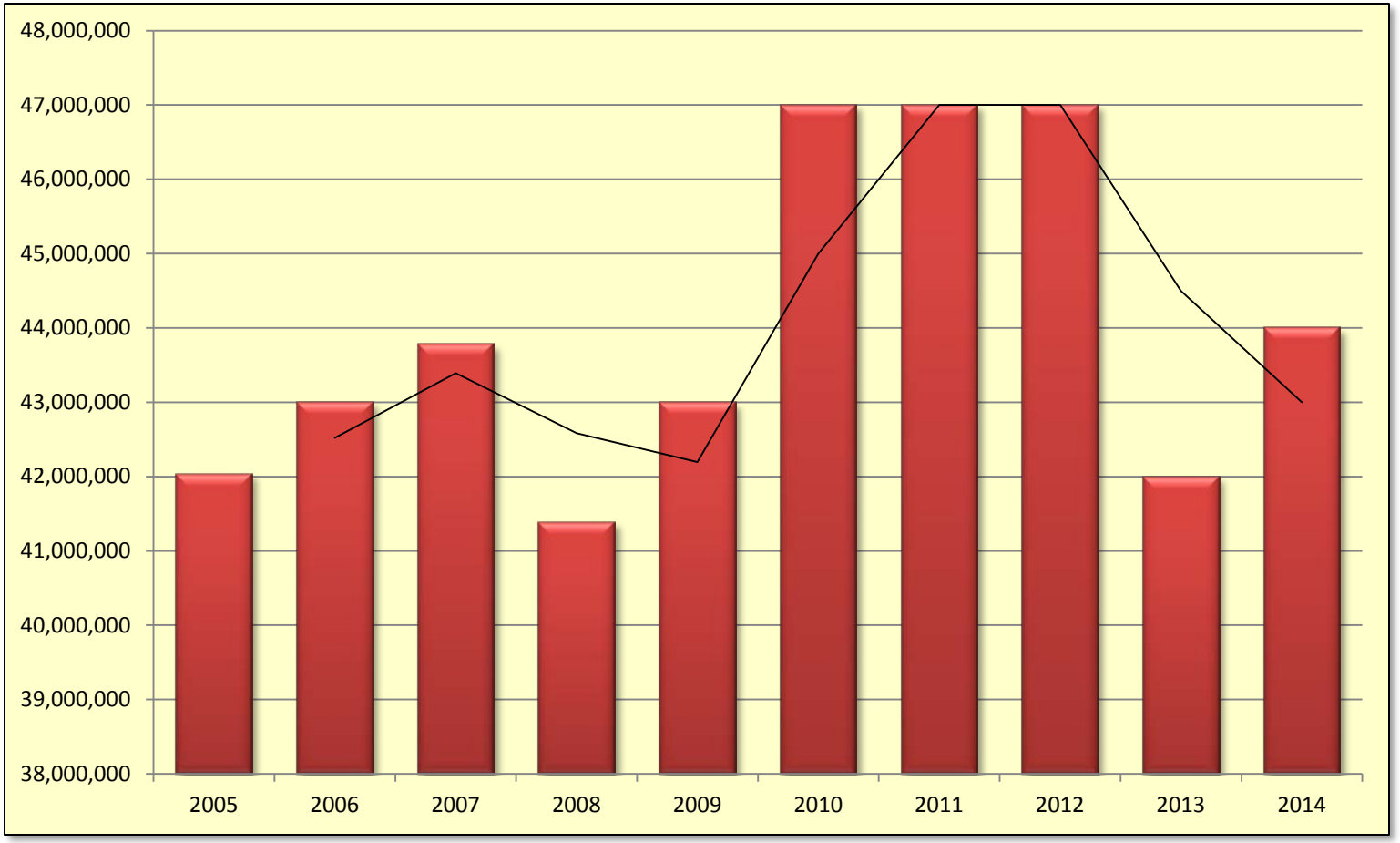
DEMAND FOR NPGS INFORMATION 2005-2014



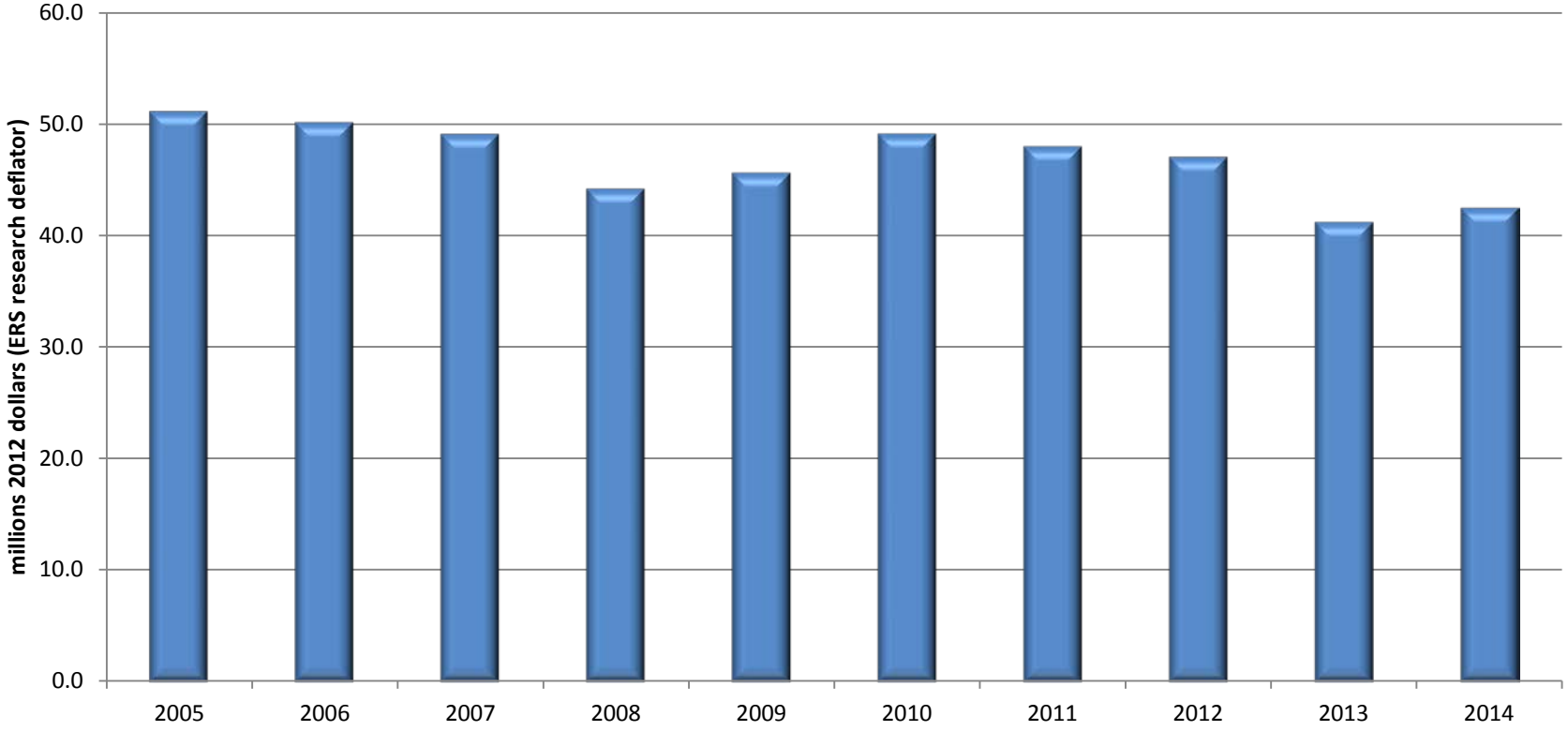
DEMAND FOR NPGS GERMPLASM 2005-2014



ARS National Plant Germplasm System budget 2005-2014



Real ARS National Plant Germplasm System Budget, 2005-2014 converted to 2012 dollars with ERS research deflator



Some key challenges that stretch the NPGS's resources

- **Managing and expanding the NPGS operational capacity and infrastructure to meet the increased demand for germplasm and associated information**
- **Fulfilling the demand for additional germplasm characterizations/evaluations**
- **Acquiring and conserving germplasm of crop wild relatives**
- **BMPs and procedures for managing accessions (and breeding stocks) with GE traits and the occurrence of adventitious presence (AP)**

A key priority: Crop Vulnerability Statements (CVS)

- **Assessing crop genetic vulnerability and setting NPGS priorities accordingly.**
  - **Template for constructing crop vulnerability statements**
  - **Some CGC have published, or plan to publish, their CVS—e.g., Volk et al. 2014 The vulnerability of US apple (Malus) genetic resources. Genet. Resour. Crop Evol. DOI 10.1007/s10722-014-0194-2.**
  - **But, CVS need not be as formal as that. Web-style content is fine.**
  - **It's more important that the CVS be updated frequently; perhaps devote the first part of each CGC meeting to briefly reviewing and updating the CVS.**

Genetic Resource Management Priorities

- Acquisition
- Maintenance
- Regeneration
- Documentation and Data Management
- Distribution
- Characterization
- Evaluation
- Enhancement
- Research in support of the preceding priorities