2024 Phaseolus Crop Germplasm Committee Minutes Meeting

Venue: Dr. Emmalea Ernest hosted the meeting at the University of Delaware, Carvel Research & Education Center, 16483 County Seat Hwy, Georgetown, DE 19947

Date: August 20, 2024; 2:30-3:30 pm EST

1) Carlos A. Urrea, Chairperson, started the meeting at 2:30 pm and welcomed the participants and asked for approval of last minutes meeting. Tim Porch made the motion, and Juan Osorno seconded the motion. The list of participants was shared previously with the group. Carlos Urrea will update it.

2) Dr. Gary R. Kinard, USDA-ARS, Research Leader, National Germplasm Resources Laboratory visited with the group virtually about the 2024 NGRL Report (Attachment 1) and introduced Dr. Gayle Volk, from USDA-ARS Agricultural Genetic Resources Preservation Research located in Fort Collins, CO. Dr. Gayle Volk develops and implements improved management techniques for vegetatively propagated genebank collections. She is also co-coordinator of a project creating training materials for plant genetic resources conservation and use. She presented several training topics like Genebank Fundamentals, Collection Maintenance, Phenotyping and Genotyping, Crop Wild Relatives; and talked about training formats, e-books.

3) Update of PCGC-funded projects:

- ***2023: Evaluation of Bean common mosaic virus isolates that persist in NPGS tepary bean accessions and differential response of 8 tepary bean diversity panel populations to infection by tepary bean-adapted BCMV isolates. Dr. Judith Brown, The University of Arizona:***

a. Evaluated three AZ tepary bean land races and nine USDA accessions for BCMV infection and/or 'virus load' by RT-PCR amplification, with optimized BCMV detection of tepary bean isolates.
b. Determined the complete BCMV genome sequence associated with AZ land races and USDA accessions harboring seed-borne BCMV.
c. Characterized the BCMV genome sequences with respect to genome size, coding regions, and nucleotide and amino acid composition.
d. Analyzed (a) BCMV genomic diversity, phylogenetic relationships, and molecular clock (mutation rates/times of divergence) among BCMV tepary bean seed-borne isolates; (b) tested the hypothesis that certain isolates have co-evolved with tepary bean nearly exclusively during seed-transmission; (c) based on the results, two isolates were identified as putative tepary-bean adapted isolates for future work.
e. Total RNA has been isolated from the first and third trifoliate leaves of the AZ Black seed color isolate and prepared for transcriptome (large RNAs) and virus-small interfering (vs.) RNA analyses (5 replicates each). The reads will be assembled and annotated, and will serve as baseline expression profiles from which significantly over-expressed or under-expressed genes will be subjected to metabolic/biochemical pathway analysis in KEGG.
f. Because of funding constraints at UA that restrict use of the account planned to supplement sequencing costs, 8-10 tepary bean accessions will be inoculated with one BCMV isolate, AZ-

Black seeded (instead of two BCMV isolates proposed). Total RNA will be isolated, converted to cDNA, and analyzed by real-time quantitative reverse transcriptase PCR amplification to quantify expression selected transcripts identified in aim 5 that reflect tepary bean response to BCMV infection including potentially defense pathways, gene silencing pathways, and metabolic pathways responsive to virus infection and/or other biotic stress pathways that may intersect with those responsive to virus infection.

- ***2024: Assessing phenotypic diversity of Lima bean (Phaseolus lunatus) accessions. Dr. Jenna Hershberger, Clemson University, SC.***

Lima bean (*Phaseolus lunatus*) is the second most economically important of the five domesticated Phaseolus species, but the majority of the lima accessions held by NPGS are uncharacterized, limiting their use in breeding. In a new NPGS Horticultural Germplasm Evaluation project that started this summer, Clemson conducted a field trial to phenotype 291 accessions for multiple traits relevant to ongoing breeding efforts, including leaf shape, disease resistance, plant architecture, and photoperiod sensitivity traits. Seeds of each accession were imaged using a flatbed scanner. After image analysis to extract seed size, shape, and color, these data and all field-collected data will be entered into GRIN Global.

Validation of PACE markers for photoperiod sensitivity and growth habit is underway using 14 segregating F_2 families that were developed by NPGS Phaseolus curator Sarah Dohle. Individual plants from each family have been phenotyped and leaf tissue was collected. A new qPCR machine is currently being installed at Clemson, after which PACE markers developed by UC Davis will be tested on the collected tissue samples. Additional planned project activities include winter greenhouse regenerations of vulnerable accessions by Collaborator Dohle, during which growing degree days to flowering and other phenological traits will be collected. As with all phenotypes collected at Clemson, these data will be made publicly available via GRIN Global after collection.

- ***2024: Plant exploration in New Mexico to collect wild species of Phaseolus acutifolius and P. filiformis germplasm for crop improvement (phase 2). Dr. Daniel Debouck.***

The drying of the West and other parts of Mesoamerica is happening now, also as a historic trend, with profound implications for cropping systems therein. Grains with low water requirements and high value, to pay for transportation, should be made available to farmers. Among the five bean cultigens, in relation to tolerance to drought, tepary bean had an ecological head start, and has indeed been grown by native Amerindians in the Southwest for millennia. In the USDA germplasm collection, there are less than five accessions of wild Phaseolus beans from New Mexico in the spring of 2023, thus limiting current and future breeding efforts.

In spite of late and erratic rainfalls, the 8-day exploration of 2023 supported by USDA and CIAT resulted in 14 populations found in SW New Mexico, namely nine populations of wild P. *acutifolius* and one of *P. filiformis*. Most plants were found at seedling or early flowering stage, limiting the sampling of seeds for germplasm conservation. But this phenology allowed the team to collect Rhizobia and rhizosphere soil samples for twelve populations. These populations will be again visited in 2024 in order to improve the seed sampling for USDA Pullman and CIAT genebanks. Prospects for higher availability of soil moisture seem to prevail in the Gila area

allowing the team to visit more populations, some found since the 1840s and identified in the Herbaria studied since 1978.

4) Status of the Phaseolus Germplasm Collection, Sarah Dohle (Phaseolus Curator) (attached);

5) New business

a. Change of Committee Officers, Membership. Carlos Urrea nominated Valerio Hoyos as the new PCGC Chairperson. Juan Osorno seconded. Valerio asked about his duties. Carlos Urrea explained the following:

a. Attend an annual meeting for all CGC Chairs; b. Coordinate the annual PCGC Characterization Proposals; c. Coordinate the annual Exploration Proposals; d. Prepare and lead the annual PCGC meeting; and d. Submit the minutes from the meetings.

6) Next meeting will be in Lincoln, Nebraska at the Embassy Suites, 1040 P Street, 68508 on November 6, 2025. Carlos Urrea will host the meeting.

8) The meeting was adjourned at 3:30 pm.

Carlos A. Urrea, Acting Secretary

APPENDIX 1. 2024 NGRL Report- Dr. Gary Kinard

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

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Appendix 2

Phaseolus Crop Germplasm Committee

Curator Report Presented August 20, 2024

Prepared by Sarah Dohle sarah.dohle@usda.gov

National plant Germplasm System news: A new Strategic Plan for NPGS requested by Congress in the 2018 Farm Bill is now public. The Plan is described in 4 documents, a 2-page infographic that distills the key points, a 29-page synopsis, a 208-page document covering the major plant genetic resource management, programmatic, and budgetary details, and an 87-page supplement with crop specific details. At this time the plan has not been funded. Check out the Phaseolus specific opportunities and consider efforts to move the plan forward.

Plant Germplasm Introduction & Testing Research Unit aka Western Regional Plant Introduction Station, a joint project of USDA and 13 Western Land Grant Universities. We hold a total +100,000 crop accessions in Pullman, WA with five curation projects.

Within the last year we have celebrated the retirements of our plant pathology technician Shari Lupien (Feb. 2024), and cool season food legume curator Dr. Clarice Coyne (March 2004). We hired 4 new full-time staff on our W-6 Multistate Project including seed storage technician Kun Fang (October 2023), horticulture crops technician Sam Charpentier (March 2024), temperate forage legumes technician Adriana Cifuentes (April 2024), and Pullman Farm assistant Griffin Stauffenberg (May 2024). We are in the process of filling our Phaseolus bean technician position, vacant since November 2023.

We plan to host field tours at our Pullman Farm summer 2025, so please reach out if you plan to be in the area.

Phaseolus Plant Genetic Collection Additions News:

The USDA-ARS Plant Exploration Office supported a *Phaseolus* collection trip to New Mexico fall 2023.

- Heat and drought tolerant wild bean relatives were collected by a collaborative team from the Alliance of Bioversity and the International Center for Tropical Agriculture (CIAT), New Mexico State University, and USDA-ARS National Plant Germplasm System. Team members included Daniel Debouck, Sarah Dohle, Marcela Santaella, Luis Santos, Richard Pratt and Milan Urban.
- The exploration resulted in collections of wild bean species (P. acutifolius, P. filiformis, P. grayanus, and P. parvulus) from 14 populations in southern New Mexico. The seeds collected for 10 wild tepary (P. acutifolius) have successfully undergone one cycle of regenerations in greenhouses in Pullman and will soon be available to cooperators (early 2025).
- Fall 2024 will be a 2nd year of exploration in New Mexico (also lead by Drs. Debouck and Pratt), with anticipated increased success because of 2023 scouting and 2024 monsoon rains being plentiful.

Expired PVP

- Calander year 2023 and 2024, added 15 and 7 expired PVP accessions respectively.

Phaseolus Plant Genetic Characterization News:

There is a backlog of characterization data to add to GRIN, including but not limited to information on stem blight, bruchid resistance, anthracnose, BCMNV, root architecture, seedling growth rates, seed size and shape, Fusarium cuneirostrum (root rot), F. oxysporum (wilt), F. acuminatum, F. Brasiliense, seed nutrition traits, growth habit and photoperiod sensitivity.

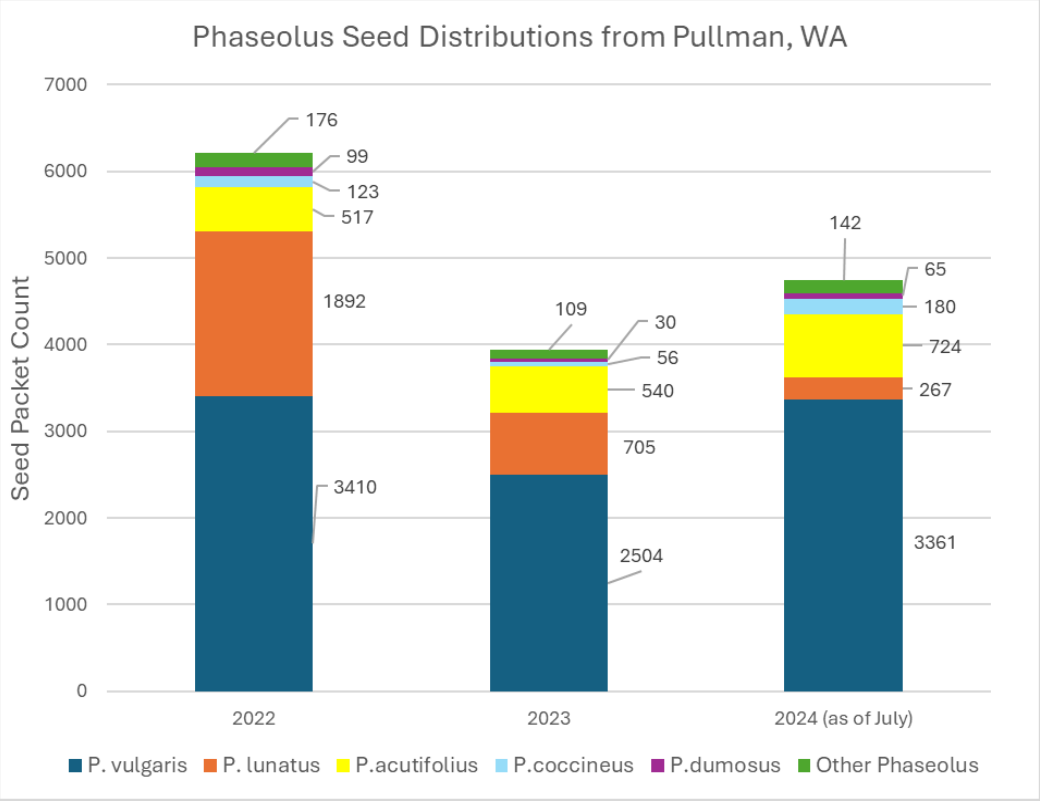
Characterization initiatives

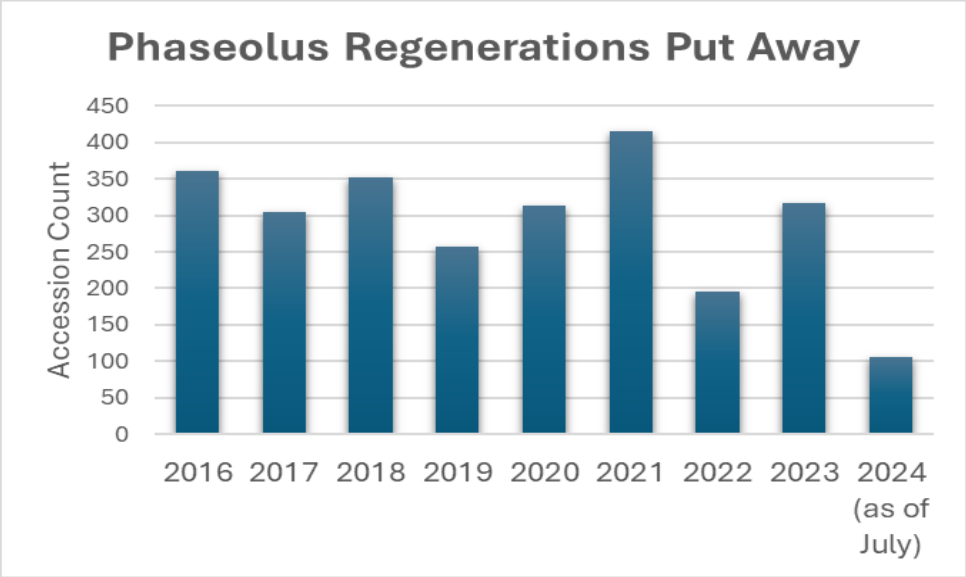
- Summer 2024 tested growing procedures for beans (*P. vulgaris*, *P. lunatus*, *P. acutifolius*) in the field at Pullman, WA to record field traits. Drip irrigation, limited trellising, 2 planting dates (5/22, and 6/6).
- A crowdsource characterization pilot project is utilizing a nationwide network of volunteer growers to evaluate 20 bean accessions. Mid-season results show ~100 individuals reporting agronomic and culinary traits on each accession from 15 locations on average. https://app.seedlinked.com/en-US/trials/2323/registration (Collaboration with Nico Enjalbert from SeedLinked)
- SCRI Lima Beans (year-1 of 4) – Ongoing genotypic and phenotypic analysis of ~700 lima bean accessions, as well as marker development for predicting photoperiod sensitivity.
- SCRI Popping Beans (year-0 of 4) – Greenhouse-based Phenotypic and Agronomic Evaluation: complete USDA nuña collection of diverse genebank accessions (year-1 planned activity)
- Building Better Beans – NIR and hyperspectral scanning of bean seeds to create htp methods of analyzing seed nutrients with Darren Drewry from Ohio State University.

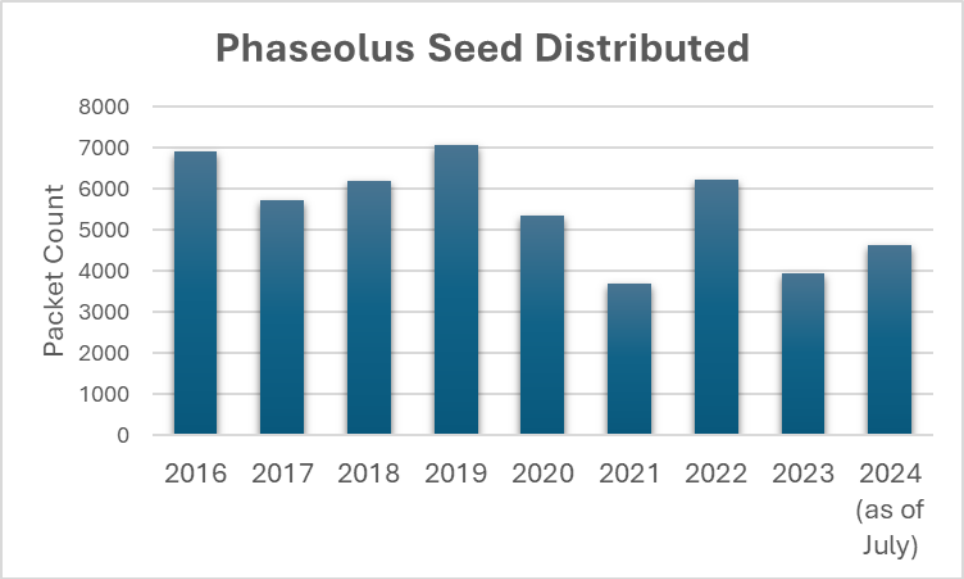
Regeneration initiatives

Phaseolus Collection Status July 2024:

Taxon	Accessions	Backed up at NCGRP		Available	
	Count	Count	Portion	Count	Portion
P. vulgaris	13,774	12,001	87%	12,077	88%
P. lunatus	2,273	686	30%	728	32%
P. acutifolius	483	168	35%	205	42%
P. coccineus	482	198	41%	23	5%
P. dumosus	97	77	79%	47	48%
P. spp. and hybr.	216	65	30%	92	43%
P. 'other'	528	85	16%	153	29%
Total	17,853	13,280	74%	13,325	75%







Challenges & Opportunities

- Regeneration capacity for 380 when all greenhouses are functional, but steam does not work consistantly in the largest greenhouses which holds 150 accessions, which makes winter photoperiod sensitive regenerations extra challenging.
- Greenhouse regenerations lack oportunity for characterization.
- Non-vulgaris species are less backed up and available, but very much in demand.

Input from Phaseolus CGC Wanted

Crop trait ontology
Thoughts on priorities for germplasm collection
Germination testing
BCMV testing
Regenerations
Characterizations
Other
Timeline for next Phaseolus Germplasm Vulnerability and Resilience statement