2024 USDA SOYBEAN GERMPLASM COLLECTION ANNUAL REPORT

Soybean Breeder’s Workshop - February 2025

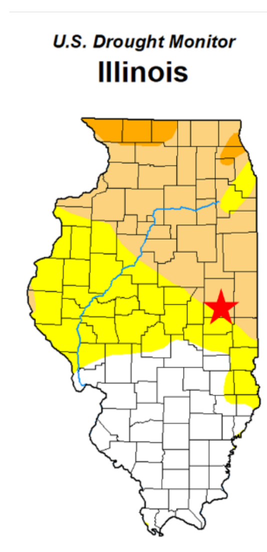
The USDA National Soybean Germplasm Collection’s mission is to be the most diverse and well-documented soybean germplasm collection in the world. We are the largest collection which freely distributes seed packets to individuals and organizations around the world as part of its responsibility to conserve and make available a wide range of soybean genetic resources for research, breeding, and educational purposes.

Summary

- Late summer drought conditions hastened harvest across the Midwest
- Vacancy at Curator since November 2024
- Hiring of Zhanyou Xu as Research Leader
- Hiring of Lilian Miranda as Research Geneticist (soybean breeder)
- Hiring of Michael Peters as Agricultural Science Research Technician
- Purchased 4-row planter, 2-row combine, 4-row field cultivator, water reel
- Construction of -18°C cold room and upgrades to 4°C cold room

Below is a summary table for the USDA Soybean Germplasm Collection:

Distribution		**Maintenance**	
Packets	23,676	Seed stored	2,100
Accessions	11,293	Seed increases	1,360
Individuals	255	New accessions	212
Countries	15	Germinations	1,250
NSSL	800	Photos	0



Distribution

In 2024, the Collection staff distributed 23,676 seed packets encompassing 11,293 accessions from the Collection in response to 413 requests from 255 individuals in the United States and 15 countries. This high demand indicates the value of this collection and the ability of the staff to fulfill orders. The Soybean Collection ranked 4th in 2024 for the total number of seed packets distributed across the entire National Plant Germplasm System (NPGS); behind only the Plant Introduction Stations which each manage multiple distinct crop species.

The Collection includes many different types of soybean germplasm, such as landraces, wild relatives, and modern cultivars, and it is updated with new materials when the opportunity presents itself. Crop wild relatives are an important part of the Collection, as they can serve as a source of genetic diversity and novel traits that can be used to improve soybean breeding and genetics research.

Most requests (23,189 seed packets) in 2024 were for *Glycine max* (soybean) and *G. soja* (wild soybean). However, there were also 14 requests for 301 seed packets representing 260 accessions of *Glycine spp*. (perennial *Glycine*). Additionally, backup seed samples for 800 accessions were sent to the National Laboratory for Genetic Resources Preservation (NLGRP) in Ft. Collins in 2024.

Seed increases

The integrity and availability of the Collection is an ongoing process that is ensured by replacing the seed in storage. The Collection staff grew 1,360 accessions for seed replacement in 2024: 250 accessions at Urbana, Illinois; 800 accessions at Stoneville, Mississippi; 110 accessions at Fargo, North Dakota; and 200 accessions at Puerto Rico. The Collection staff extends their gratitude to Carrie Miranda and the North Dakota State University team for their cooperation in growing the earliest maturing accessions. Additionally, 175 of perennial *Glycine* were grown for seed replenishment in 2024. These accessions are cultivated in a greenhouse equipped with blackout curtains to manipulate the photoperiod (daylight hours) received by the plants. The Collection currently manages 19 species of perennial *Glycine.*

At the Urbana location, germplasm seed increases were scaled back for the 2024 season. Typically, seed increases are selected based on three criteria: low germination, low seed inventory, and seed sources that are 10 years old or older. However, in 2024, the focus shifted solely to low germination and low seed inventory. Seeds that are 10 years old are considered to have 50% germination by default. To account for this, seeds were packaged with excess for planting, and all plots achieved sufficient stand counts this season.

The decision to reduce seed increases was driven by several factors, including a backlog of over 4,000 unprocessed seed lots from previous seasons and anticipated disruptions caused by planned upgrades to the cold rooms. Additionally, the team was operating with one fewer staff member and was uncertain about when a new hire would begin working. This strategy is expected to continue into the upcoming season at both Urbana and Stoneville. While this approach should not impact accession availability in the short term, it may eventually lead to a decline in seed germination over time.

Staff – Urbana, IL

Dr. Zhanyou Xu was hired as Research Leader for the Soybean/Maize Germplasm, Pathology, and Genetics Research Unit, succeeding Glen Hartman. He began his career as a soybean germplasm breeder with the National Crop GenBank of China before becoming the Global Soybean Genetic Project Leader at Syngenta.

Dr. Lilian Miranda joined the Research Unit in May 2024 as a Research Geneticist, supporting the Collection as a soybean breeder and geneticist. She replaced David Walker and previously worked as a Research Geneticist with the USDA Soybean and Nitrogen Fixation Research Unit in Raleigh, NC, before becoming a Soybean Discovery Breeder at BASF.

Michael Peters joined the Collection staff in November 2024 as an Agricultural Science Research Technician. Prior to this role, he worked for the USDA Germplasm Enhancement of Maize (GEM) project in Ames, IA, where he collaborated closely with the North Central Regional Plant Introduction Station, a part of the USDA NPGS.

In November 2024, Dr. Adam Mahan departed his role as Soybean Curator. He now serves as the Research Leader at the North Central Regional Plant Introduction Station in Ames, IA, and remains actively engaged with the Collection staff to support ongoing efforts. A job description for his successor as Soybean Curator is currently being developed and will be announced when hiring resumes.

Zhanyou Xu, Research Leader	0%
Vacant, Geneticist (Curator)	100%
Benjamin Bartlett, Agronomist	100%
Michael Peters, Agricultural Science Research Technician	100%
Todd Bedford, Germplasm Support Assistant	100%
Eric Moody, Agricultural Science Research Technician	100%
Lilian Miranda, Research Geneticist	100%
Gad Yousef, Biological Science Technician	100%
Lezlie Furr, Program Support Assistant OA	33%

Staff – Stoneville, MS

Philip Handly retired in January, and Hans Hinrichsen departed for a position elsewhere within ARS during the winter season. As a result, there is some uncertainty about how many germplasm seed increases the Stoneville location will be able to manage given the current personnel vacancies.

Rusty Smith, Research Geneticist	30%
Vacant, Agronomist	70%
Robert (Matt) Kersh, Biological Science Technician	90%
Vacant, Biological Science Lab Technician	20%

New accessions

In 2024, the Collection expanded with the addition of 212 new accessions, including 23 germplasm releases, 3 public cultivars, and 172 private varieties with expired plant variety protection certificates.

Testing new accessions for glyphosate resistance in the field provides a rapid method for identifying plants capable of withstanding the herbicide, while also screening conventional seed lots for the presence of genetically engineered (GE) traits. Due to drought conditions in 2023, accessions received in both 2023 and 2024 were evaluated during the 2024 season. Newly received accessions were planted in 2-row, 10-foot-long plots, with one row designated for glyphosate treatment.

The glyphosate-treated row was compared to the untreated row to observe the plants' herbicide response. If plants in the treated row showed little or no damage, it was assumed that the seed lot contained glyphosate-resistant seeds. In cases where some plants survived the treatment, 10 plants from the remaining untreated rows were sampled and subjected to a glyphosate strip test for confirmation. Following testing, the plots were mowed down before flowering to prevent cross-pollination.

No accessions were found to be positive for glyphosate resistance during the 2024 evaluation.

Genetically Engineered (GE) Accessions

The National Plant Germplasm System (NPGS) is working with the USDA, EPA, and relevant germplasm curators to draft protocols for the safe maintenance and distribution of genetically engineered (GE) cultivars. To prevent contamination, GE cultivars must be handled separately from non-GE cultivars, including conventional and landrace soybeans. Strict protocols for field planting, storage, seed handling, and cleaning of threshing equipment are essential to maintain the integrity of the Collection.

Recently, accessions containing tolerance to glyphosate herbicide were approved for distribution to seed requestors. The Collection is working to receive these accessions from the National Laboratory for Genetic Resources Preservation (NLGRP) in Ft. Collins and make ex-PVP lines with this herbicide trait available for distribution. Of the 212 new accessions received by the Collection in 2024, 172 were GE cultivars. That same year, 127 GE accessions were requested across 7 orders.

The NPGS committee on GE accessions, chaired by Adam Mahan, continues to provide guidance and draft protocols for managing GE traits, particularly herbicide resistance, in germplasm collections. However, the distribution of insect-resistant GE traits, which require EPA registration for commercial sales, remains unresolved. Discussions between NPGS and EPA have yet to determine how to handle ex-PVP cultivars with expired GE insecticide traits.

Looking ahead, over 800 GE cultivars are expected to become available to the Collection through expired ex-PVP lines within the next decade. This influx of GE accessions will place significant strain on operational protocols and cold-room storage capacity. The soybean research community must address how to manage the increasing number of accessions with GE traits and the associated resource challenges.

One proposed strategy is to limit the maintenance of GE accessions with identical traits. Instead of replenishing every accession with the same GE trait, the Collection could maintain one or a few representative accessions for each maturity group with the trait, distributing the rest until inventories are exhausted. In this scenario, the original voucher of these GE accessions would remain stored at the NLGRP in Ft. Collins, even if they are no longer actively distributed as part of the Collection.

Germinations

By conducting germination tests on recently harvested seed, the collection staff can also prevent poor quality backup seed from being sent to other seed banks or distributed for research or breeding purposes. Germination tests assess the seed on three criteria; whether the seed germinates, is rotten, or is hard (i.e. didn't imbibe water).

In 2024, germination tests were conducted on 1,250 accessions. For the 2023 accessions grown in Urbana, an average of 81% of the seed germinated successfully, while 8% fell below the 50% germination threshold, necessitating regrowth. For the 2022 accessions grown in Stoneville, an average of 84% of the seed germinated successfully, with 4% falling below the 50% threshold for regrowth.

National Strategic Germplasm and Cultivar Collection Assessment and Utilization Plan (aka – the Plan)

The 2018 Farm Bill directed the USDA to "develop and implement a national strategic germplasm and cultivar collection assessment and utilization plan that takes into consideration the resources and research necessary to address the significant backlog of characterization and maintenance of existing accessions considered to be critical to preserve the viability of, and public access to, germplasm and cultivars." In response, the Plan was developed in the form of three documents, all of which are listed at the ARS GRIN website. https://www.ars-grin.gov/Pages/NPGS

The American Seed Trade Association (ASTA) worked closely with the NPGS to develop the framework for the Plan. As such, ASTA has made the implementation of the Plan a key priority for increasing the authorization of appropriations for the National Genetic Resources Program. https://www.betterseed.org/farm-bill/

Recently, NPGS leadership, in collaboration with genebank research leaders, began developing crop summaries to condense key highlights of this plan into concise one-page documents. These summaries will be made available once finalized and are intended to be distributed to the public.

Database

GRIN-Global is a web-based software system developed by the USDA Agricultural Research Service (ARS) to manage germplasm operations. Data from the Collection is available in GRIN-Global to provide easy access to information about the collection. GRIN-Global provides a wide range of tools that can help users find the information and resources they need, including a "shopping cart" feature that allows users to easily request samples of the seeds they need for their research.

This popular feature was used by seed requestors for 86% of the orders filled by Collection staff. This tool allows Collection staff to manage the request and ordering process in an efficient manner and is the preferred method to receive requests.

Beginning January 1, 2024, the U.S. National Plant Germplasm System (NPGS) will distribute all germplasm to international requestors (outside the U.S. states and territories) with the Standard Material Transfer Agreement (SMTA) of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).

Processing Harvested Seed

An optical color sorter is a tool used to more efficiently separate moldy, diseased, and poor-quality seeds from good quality seed. This is done by using sensors that detect variations in color, shape, and size of seeds. The color sorter then uses a blast of air to separate the good seeds from the bad. A 'Analytical Color Sorter' was installed, and Collection staff were trained on its operation. Previously, Collection staff would visually inspect and manually clean seed lots. This process can be time-consuming and in cases of highly diseased seed, it can take up to two hours to clean seed from a single lot. The operation of the color sorter has already improved the efficiency of the seed cleaning process and reduced the amount of time required to separate good quality seeds from bad quality seeds.

Despite being down one technician for part of 2024, the Collection staff successfully processed approximately 2,100 harvested seed lots this year. However, a significant backlog of seed cleaning remains. Seed lots from the 2021, 2022, 2023, and 2024 Urbana production—totaling approximately 4,000—still need to be processed and quality controlled. Currently, the Collection staff is able to process seed at roughly the replacement level from the previous season's harvest, averaging around 1,200 seed lots annually.

Fatty Acid Evaluation

Fatty acid analysis is an important tool for evaluating the oil in soybean seeds, as it provides information about the types and levels of fatty acids present in the seeds. We have historically collected fatty acid compositional information on all accessions as part of our evaluation process. This information is then added to the GRIN database, making it easily accessible to seed requestors. Currently we have a backlog of several thousand seed samples that require fatty acid analysis to finish up phenotypic evaluation of those accessions. Unfortunately, we have not yet found a suitable collaborator to finish up this work.

In relation to seed composition, the Collection acquired an NIR (near-infrared) analyzer, which will primarily be used for oil and protein analysis of experimental lines. Additionally, the NIR can estimate fatty acid data and will occasionally be used to screen for fatty acid mutant alleles as part of a small oleic acid breeding project. However, as directed by the Soybean CGC, fatty acid data collected via NIR on any germplasm accessions will not be posted to GRIN.

Cold Room Seed Storage

The Collection has begun construction on a new -18°C cold room, which will replace two older cold rooms that have outlived their usefulness. This new cold room will meet the guidelines for long-term seed storage as outlined by the FAO (2013) *Genebank Standards for Plant Genetic Resources for Food and Agriculture*. Additionally, upgrades are underway for the refrigeration and dehumidification systems in the primary cold room that stores the germplasm collection. Once completed, the primary cold room will consistently maintain a controlled environment of 4°C and 28% humidity. Current cold room conditions are 8-10°C and 35-40% humidity.

Soybean seeds, like most seeds, can maintain high germination rates for many years when stored at -18˚C. This is evident from many of the backup samples that are stored at -18˚C at the National Center for Genetic Resources Preservation (NCGRP) and continue to test over 80% germination rate after more than 30 years of storage. By having a proper -18˚C cold room, it can help to reduce the chances of errors and contamination that can occur during packaging, planting, growing, and harvesting. Current procedures select accessions for seed replenishment when an accession becomes 10 years old. This is based on the germination rate of the seed and the perceived degradation of seed germination in the current storage conditions. In 2023 at Urbana, roughly 81% of the accessions were selected for seed increases due to being 10 years old (79% at Costa Rica, 89% at Puerto Rico, and 69% at Stoneville), and not because of low seed quantities.

Building Upgrades

The Urbana location received funds to address deferred maintenance repairs across multiple federal buildings. A portion of these funds is expected to cover upcoming roof and gutter repairs, which will enhance the overall safety of seed storage.

Based on the UIUC Campus Master Plan the University of Illinois Department of Crop Sciences will eventually relocate university farm employees to the Crop Sciences Research and Education Center on South First Street. When this move occurs, the Soybean Collection will also need to be relocated, requiring the construction of a new building. To that end, a soybean building functional statement has been crafted with the oversight of the USDA-ARS and University leadership. With the estimated cost of a new facility exceeding $10 million, this would result in an annual maintenance expense drawn from the Soybean Germplasm budget of several hundred thousand dollars. Therefore, any new building construction must be accompanied by increased appropriations to maintain adequate funding for germplasm support.

Farm Equipment Purchases

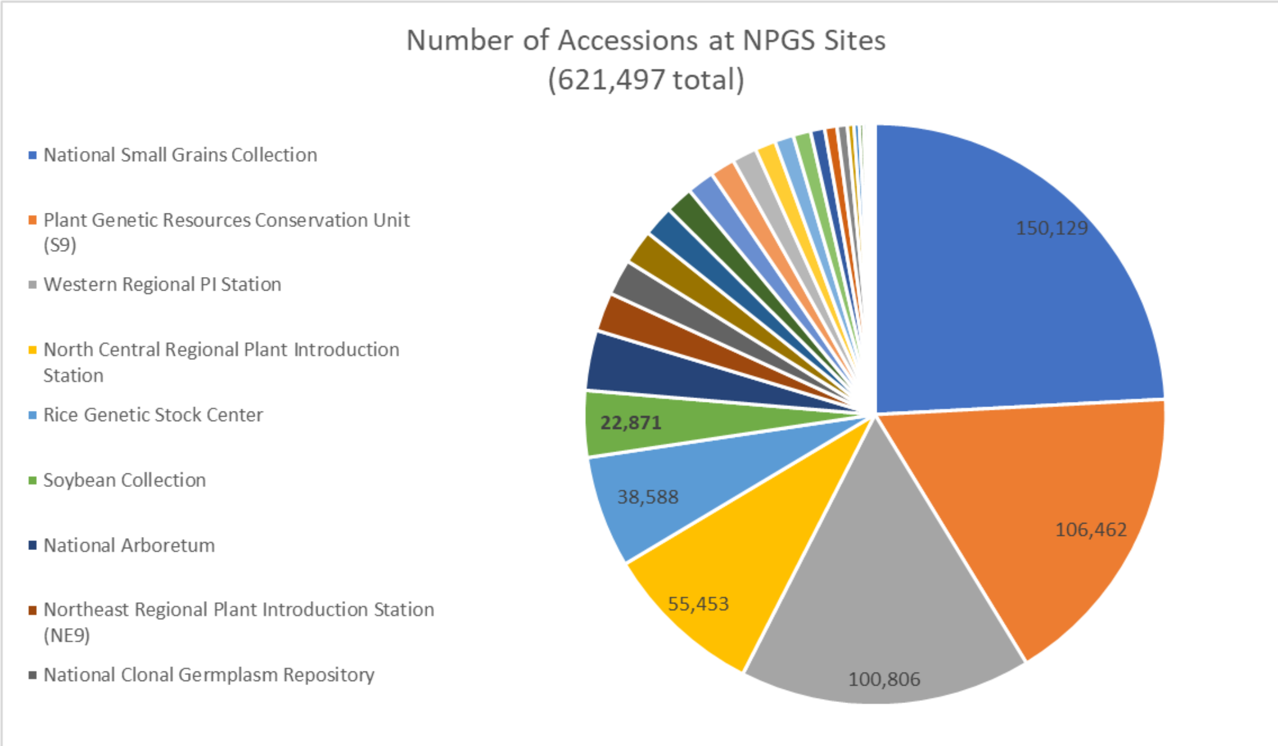
The Collection relies on periodic equipment purchases to support its operations, with regular upgrades necessary to maintain efficiency. Typically, large government acquisitions are made with financial assistance from the Area Office. This year, the Collection successfully completed several major equipment purchases, including a 4-row Cone Plot Planter. The new planter can accommodate 30”–40” row spacing, replacing both the 2-row and 4-row planters currently in use. It also offers optional upgrades, such as GPS tripping to replace the existing cable system and automatic seed tray indexing to enhance planting efficiency.

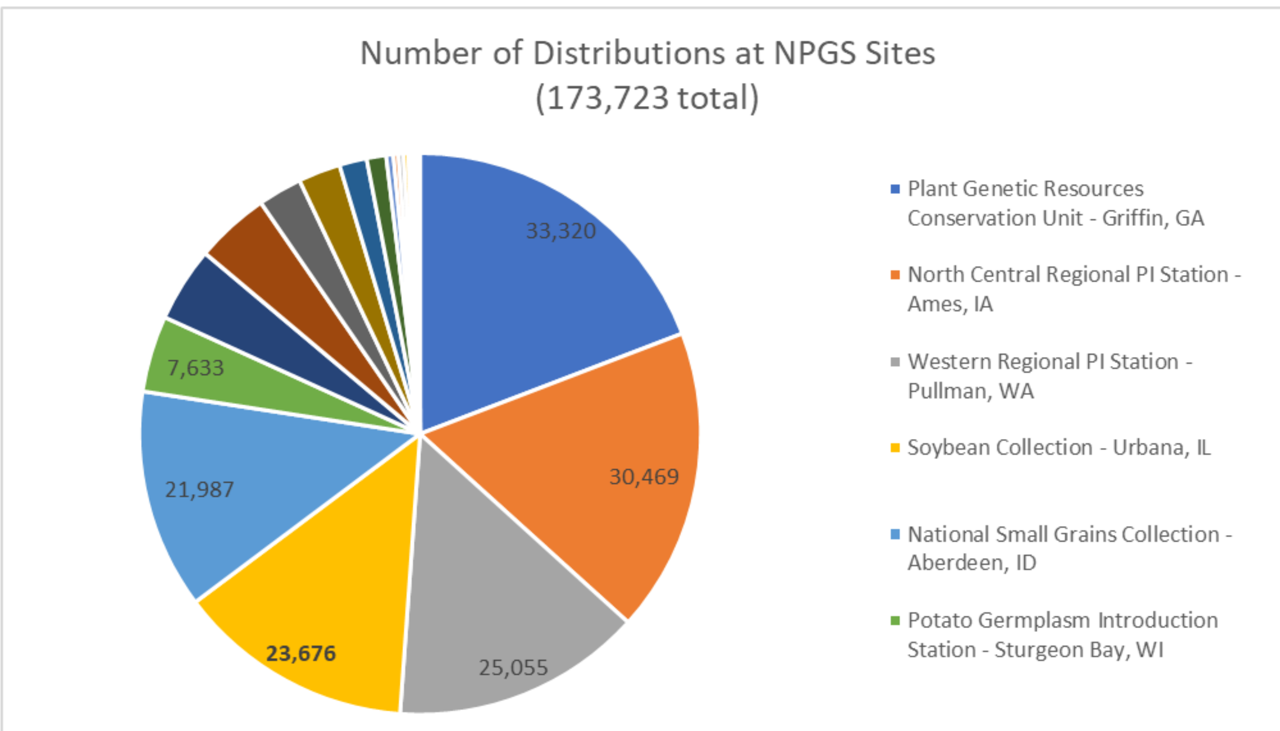
In 2023, the Collection purchased a new small plot combine, replacing the previous model from 1995. This new combine was used during the Fall 2024 harvest and performed as expected. Additionally, the Collection acquired a 4-row field cultivator and a water reel with 1,200 feet of irrigation pipe in 2023. Weed control was significantly improved with the new cultivator, and the water reel functioned as intended throughout the season.

A list of equipment is below:

Soybean Farm Equipment

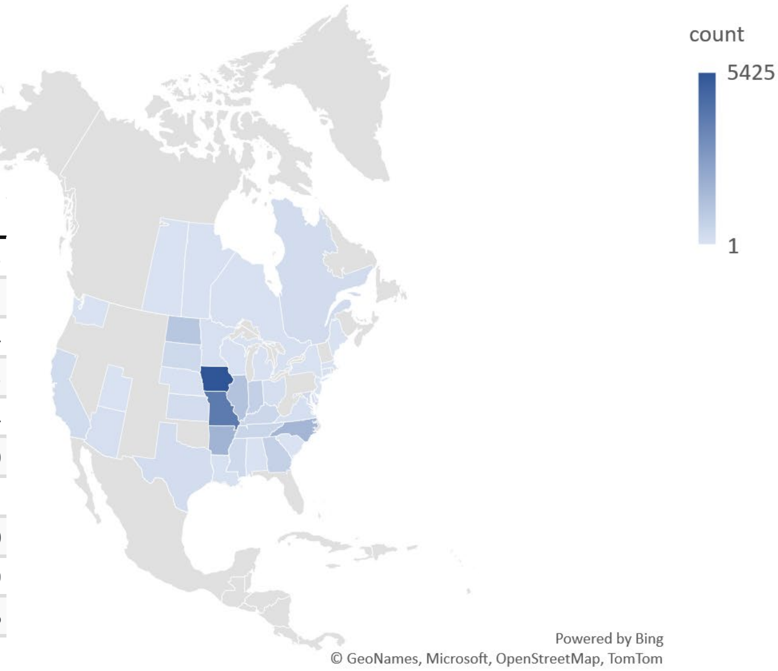
Year	Description	Year	Description
1994	1-row combine	1991	tractor
1997	1-row combine	2001	tractor
1995	2-row combine	2015	tractor
2024	2-row combine	1998	2-row planter
2001	plot combine	2000	4-row planter
1993	thresher	2024	4-row planter
2020	thresher		


Number of Accessions at NPGS Sites
(621,497 total)
National Small Grains Collection
Plant Genetic Resources Conservation Unit (S9)
Western Regional PI Station
North Central Regional Plant Introduction Station
Rice Genetic Stock Center
Soybean Collection
National Arboretum
Northeast Regional Plant Introduction Station (NE9)
National Clonal Germplasm Repository
150,129
106,462
100,806
55,453
38,588
22,871

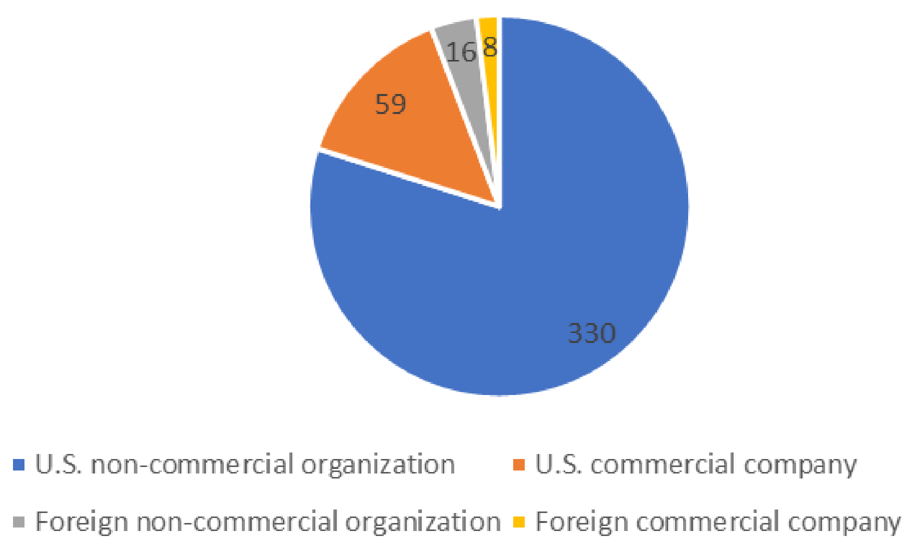

Number of Distributions at NPGS Sites
(173,723 total)
Plant Genetic Resources Conservation Unit - Griffin, GA
North Central Regional PI Station - Ames, IA
Western Regional PI Station - Pullman, WA
Soybean Collection - Urbana, IL
National Small Grains Collection - Aberdeen, ID
Potato Germplasm Introduction Station - Sturgeon Bay, WI
33,320
30,469
25,055
23,676
21,987
7,633

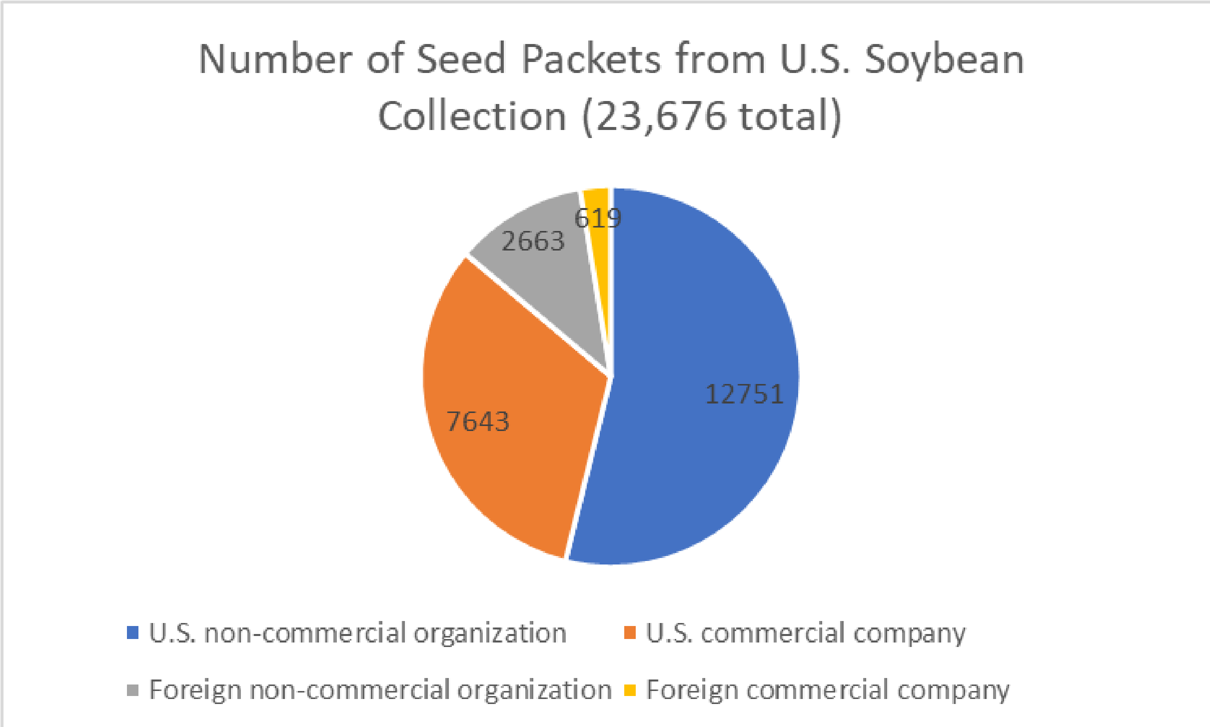
Number of Distributions from the U.S. Soybean Collection

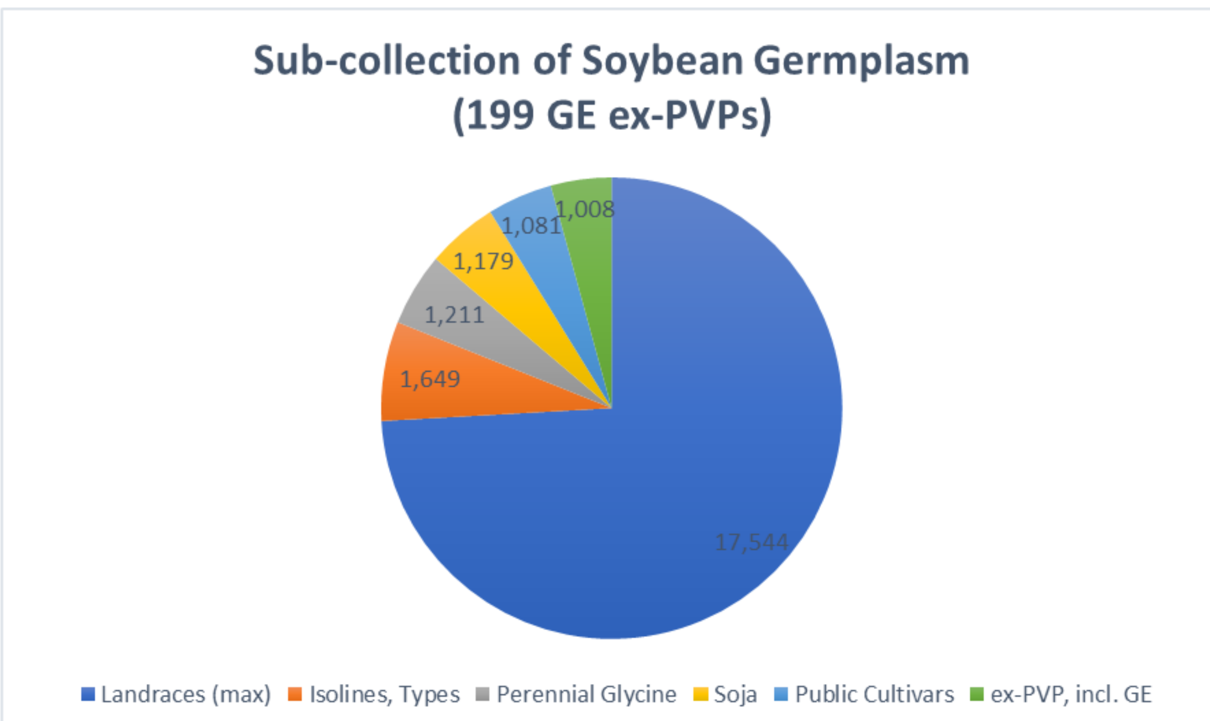
state	count
Iowa	5425
Missouri	3963
Arkansas	1784
North Carolina	1705
Illinois	1214
North Dakota	1070
Indiana	691
Georgia	680
Tennessee	489
Kentucky	436



Number of Orders from U.S. Soybean Collection (413 total)




Number of Seed Packets from U.S. Soybean Collection (23,676 total)
619
2663
12751
7643
U.S. non-commercial organization
U.S. commercial company
Foreign non-commercial organization
Foreign commercial company


Sub-collection of Soybean Germplasm (199 GE ex-PVPs)
1,081
1,008
1,179
1,211
1,649
17,544
Landraces (max)
Isolines, Types
Perennial Glycine
Soja
Public Cultivars
ex-PVP, incl. GE

Summary inventory tables for each sub-collection in the USDA Soybean Germplasm Collection.

USDA Soybean Germplasm Collection Inventory	
Glycine max	17,553
Perennial species	1,213
Glycine soja	1,179
Private cultivars	810
Modern cultivars	573
Germplasm releases	353
Isoline - Clark	295
Old cultivars	208
Genetic types	197
Isoline - Harosoy	141
Isoline - Williams	102
Isoline - Other	66
Pigment mutants	47
GE material	199
Total	**22,936**

Glycine max	
Maturity Group	**# of accessions**
MG 000	144
MG 00	526
MG 0	1,162
MG I	1,776
MG II	2,279
MG III	2,221
MG IV	4,471
MG V	2,924
MG VI	1,642
MG VII	1,021
MG VIII	964
MG IX	874
MG X	109

Glycine soja	
Maturity Group	**# of accessions**
MG 000	165
MG 00	52
MG 0	54
MG I	61
MG II	95
MG III	50
MG IV	85
MG V	344
MG VI	172
MG VII	90
MG VIII	5
MG IX	2
MG X	4

Perennial species	
G. tomentella	348
G. tabacina	184
G. canescens	151
G. clandestina	112
G. pescadrensis	68
G. latifolia	53
G. cyrtoloba	50
Glycine spp.	55
G. rubiginosa	37
G. microphylla	35
G. falcata	30
G. stenophita	27
G. argyrea	14
G. dolichocarpa	13
G. curvata	9
G. latrobeana	7
G. peratosa	7
G. syndetika	6
G. arenaria	5
G. pindanica	4
Total	**1,215**

There is a significant amount of publicly available data for *Glycine max*, encompassing 180 traits and nearly 1 million observations. This data, compiled through the efforts of the Collection staff along with observations provided by seed requestors and through collaborations with public and industry partners, is summarized in the tables below.

Total observations for soybeans (*Glycine max*)

category_code	title	obs	category_code	title	obs	category_code	title	obs
CHEMICAL	ARGININE	5,530	DISEASE	Phytophthora Rot Race 30T	263	MORPHOLOGY	Lodging	17,556
CHEMICAL	CYSTEINE	5,530	DISEASE	Phytophthora Rot Race 31	145	MORPHOLOGY	LOWER LEAFLET RATIO	15
CHEMICAL	human allergen P34	13,304	DISEASE	Phytophthora Rot Race 33	113	MORPHOLOGY	Mottling score	14,411
CHEMICAL	Iodine number	2,820	DISEASE	Phytophthora Rot Race 38	65	MORPHOLOGY	Other leaf traits	1,060
CHEMICAL	ISOLEUCINE	5,530	DISEASE	Phytophthora Rot Race 4	1,472	MORPHOLOGY	Other plant traits	308
CHEMICAL	LEUCINE	5,530	DISEASE	Phytophthora Rot Race 5	791	MORPHOLOGY	Other seed traits	3,816
CHEMICAL	Linoleic	22,073	DISEASE	Phytophthora Rot Race 6	139	MORPHOLOGY	Pod color	19,352
CHEMICAL	Linolenic	22,072	DISEASE	Phytophthora Rot Race 7	2,991	MORPHOLOGY	Pod length	15
CHEMICAL	LYSINE	5,530	DISEASE	Phytophthora Rot Race 8	149	MORPHOLOGY	Pubescence color	18,259
CHEMICAL	METHIONINE	7,515	DISEASE	Phytophthora Rot Race 9	96	MORPHOLOGY	Pubescence density	18,697
CHEMICAL	Oil	22,165	DISEASE	Pythium ultimum	1,289	MORPHOLOGY	Pubescence form	17,758
CHEMICAL	Oleic	21,061	DISEASE	SOUTHERN STEM CANKER	119	MORPHOLOGY	Seed coat color	19,514
CHEMICAL	Other fatty acid composition	5,762	DISEASE	Soybean mosaic virus	15	MORPHOLOGY	Seed coat luster	18,224
CHEMICAL	Palmitic	21,061	DISEASE	SOYBEAN MOSAIC VIRUS STRAIN G1	236	MORPHOLOGY	Seed quality	17,662
CHEMICAL	Petiole Ureide	2,497	DISEASE	SOYBEAN MOSAIC VIRUS STRAIN G2	107	MORPHOLOGY	Seed shape of G. soja	15
CHEMICAL	Protein	22,165	DISEASE	SOYBEAN MOSAIC VIRUS STRAIN G3	236	MORPHOLOGY	Seed Shape of Glycine max	9,571
CHEMICAL	Stachyose	5,522	DISEASE	SOYBEAN MOSAIC VIRUS STRAIN G4	26	MORPHOLOGY	Seed weight	17,705
CHEMICAL	Stearic	21,061	DISEASE	SOYBEAN MOSAIC VIRUS STRAIN G5	107	MORPHOLOGY	Stem termination score	12,566
CHEMICAL	Sucrose	5,483	DISEASE	SOYBEAN MOSAIC VIRUS STRAIN G6	236	MORPHOLOGY	Upper leaflet length	15
CHEMICAL	THREONINE	5,530	DISEASE	SOYBEAN MOSAIC VIRUS STRAIN G7	236	MORPHOLOGY	Upper leaflet shape	15
CHEMICAL	TRYPTOPHAN	5,530	DISEASE	Soybean Rust Mixed	434	NEMATODE	Cyst Nematode Race 1	758
CHEMICAL	VALINE	5,530	DISEASE	Soybean Rust Red-Brown	102	NEMATODE	Cyst Nematode Race 14	2,548
DISEASE	Bacterial pustule	3,394	DISEASE	Soybean Rust Tan	3,084	NEMATODE	Cyst Nematode Race 2	234
DISEASE	Bean Pod Mottle Virus	427	DISEASE	Soybean Sudden Death Syndrome	6,861	NEMATODE	Cyst Nematode Race 3	12,805
DISEASE	Brown stem rot	4,031	GROWTH	Height	17,676	NEMATODE	Cyst Nematode Race 4	7,404
DISEASE	Frogeye C-32 Isolate	1,678	GROWTH	Stem termination type	18,195	NEMATODE	Cyst Nematode Race 5	11,627
DISEASE	FROGEYE RACE 11	108	INSECT	Beet armyworm	5	NEMATODE	RENIFORM NEMATODE	125
DISEASE	Frogeye race 2	2,652	INSECT	Corn Ear Worm	26	OTHER	Core Subset	3,102
DISEASE	Frogeye, unspecified race	115	INSECT	DEFOLIATION	339	OTHER	Image	4,119
DISEASE	NORTHERN STEM CANKER	1,467	INSECT	Leaf hopper injury	784	PHENOLOGY	Flowering	17,696
DISEASE	Peanut Mottle Virus	2,150	INSECT	Mexican Bean Beetle damage	5,046	PHENOLOGY	Maturity date	17,688
DISEASE	Phytophthora Rot Race 1	9,950	INSECT	Soybean Aphid Resistance	4,061	PHENOLOGY	Maturity group	18,259
DISEASE	Phytophthora Rot Race 10	623	INSECT	Soybean Looper	2,278	PHENOLOGY	Twining date	14
DISEASE	Phytophthora Rot Race 12	640	INSECT	Velvetbean caterpillar	126	PRODUCTION	Yield	17,521
DISEASE	Phytophthora Rot Race 17	2,227	MOLECULAR	MATURITY LOCUS E3	119	ROOT	ROOT FLUORESCENCE	795
DISEASE	Phytophthora Rot Race 2	432	MORPHOLOGY	Branching	2,153	STRESS	Chlorosis score	4,617
DISEASE	Phytophthora Rot Race 20	652	MORPHOLOGY	Early shattering score	16,063	STRESS	HIGH TEMPERATURE	520
DISEASE	Phytophthora Rot Race 25	2,834	MORPHOLOGY	Flower color	18,255	STRESS	Salt reaction	564
DISEASE	Phytophthora Rot Race 3	2,816	MORPHOLOGY	Hilum color	19,468			
DISEASE	Phytophthora Rot Race 30	115	MORPHOLOGY	Late shattering score	13,266			

Total observations for wild soybeans (*Glycine soja*)		
category_code	**title**	**obs**
CHEMICAL	human allergen P34	1,118
CHEMICAL	Linoleic	1,243
CHEMICAL	Linolenic	1,243
CHEMICAL	Oil	1,243
CHEMICAL	Oleic	1,243
CHEMICAL	Other fatty acid composition	182
CHEMICAL	Palmitic	1,243
CHEMICAL	Protein	1,243
CHEMICAL	Stearic	1,243
DISEASE	Bean Pod Mottle Virus	117
DISEASE	Phytophthora Rot Race 3	448
DISEASE	Soybean mosaic virus	182
GROWTH	Height	182
GROWTH	Stem termination type	1
INSECT	Beet armyworm	425
INSECT	Soybean Looper	379
INSECT	Velvetbean caterpillar	408
MORPHOLOGY	Flower color	185
MORPHOLOGY	Hilum color	939
MORPHOLOGY	LEAFLET SHAPE OF GLYCINE SOJA	1,060
MORPHOLOGY	LEAFLET SIZE OF GLYCINE SOJA	1,060
MORPHOLOGY	Lower Leaflet Area	1,036
MORPHOLOGY	Lower Leaflet Aspect	1,049
MORPHOLOGY	LOWER LEAFLET RATIO	182
MORPHOLOGY	Other leaf traits	38
MORPHOLOGY	Other plant traits	3
MORPHOLOGY	Other seed traits	299
MORPHOLOGY	Pod color	1,003
MORPHOLOGY	Pod length	182
MORPHOLOGY	Pubescence color	185
MORPHOLOGY	Pubescence density	1,001
MORPHOLOGY	Pubescence form	270
MORPHOLOGY	Seed coat color	1,040
MORPHOLOGY	Seed coat luster	185
MORPHOLOGY	Seed shape of G. soja	185
MORPHOLOGY	Seed weight	182
MORPHOLOGY	Upper leaflet length	182
MORPHOLOGY	Upper leaflet shape	182
NEMATODE	Cyst Nematode Race 1	1,078
NEMATODE	Cyst Nematode Race 3	545
NEMATODE	Cyst Nematode Race 4	1
NEMATODE	Cyst Nematode Race 5	547
OTHER	Core Subset	81
OTHER	Image	1,847
PHENOLOGY	Flowering	1,246
PHENOLOGY	Maturity date	1,245
PHENOLOGY	Maturity group	185
PHENOLOGY	Twining date	182
STRESS	Chlorosis score	21

Total observations for perennial *Glycine*		
category_code	**title**	**obs**
CHEMICAL	Bowman-Birk Inhibitor	560
CYTOLOGIC	Chromosome number	861
DISEASE	SCLEROTINIA STEM ROT	777
DISEASE	SUDDEN DEATH SYNDROME	754
MORPHOLOGY	Adventitious roots	319
MORPHOLOGY	Leaflet arrangement	291
MORPHOLOGY	Upper pubescence type	290
MORPHOLOGY	Upper terminal leaflet length	265
MORPHOLOGY	Upper terminal leaflet shape	292
MORPHOLOGY	Upper terminal leaflet width	293
NEMATODE	Soybean Cyst Nematode Race 3	490
OTHER	CORE SUBSET	115
OTHER	IMAGE	3,008