

# USDA SOYBEAN GERmplasm COLLECTION REPORT -- 2010

February 2011

In 2010, we distributed 29,510 seed lots from 14,752 accessions from the USDA Soybean Germplasm Collection in response to 705 requests from 346 individuals. There were 622 domestic requests (88% of the total) with a total of 21,485 seed packets representing 11,182 accessions sent to 289 researchers from 41 states and the U.S. Virgin Islands. Domestically, public scientists made 447 requests and scientists with commercial companies made 175 requests. There were 8,025 seed packets of 6,899 accessions in 83 orders sent to 57 scientists in 20 countries. Thirty-four requests were made for 1411 seed packets of 994 perennial *Glycine* accessions. We also sent backup seeds of 509 accessions to the National Center for Genetic Resources Preservation and 1,884 accessions for storage in the Svalbard Arctic Seed Vault. We have now sent 8,850 accessions to Svalbard. A sample for Svalbard is packaged each time new seeds are added to the Collection so over a period of 10 years all annual accessions will have been sent.

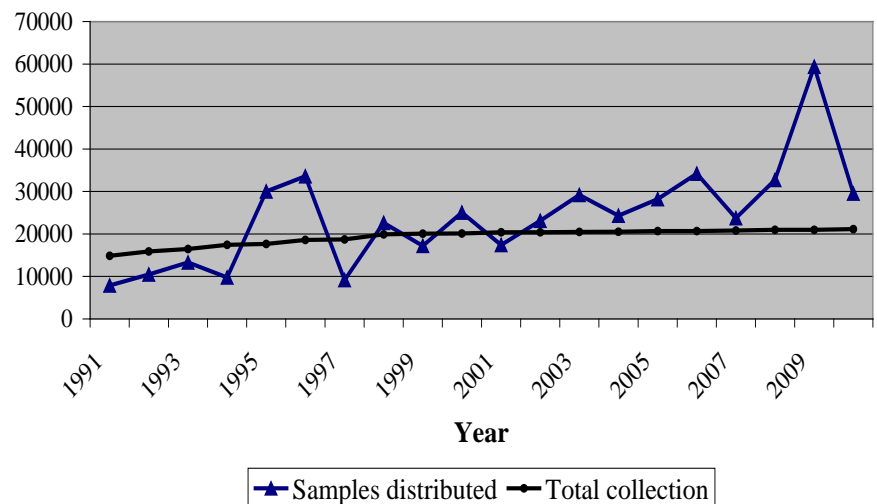
We planted 2,501 accessions of *G. max* for seed replacement in the Collection. These were planted at three locations: 1,635 accessions at Urbana, 695 accessions at Stoneville, and 171 accessions in Costa Rica. Plots for pure lining new accessions were planted in Urbana, Stoneville, and Costa Rica. 107 new *Glycine max* pure line accessions from Vietnam were added to the Collection.

We received seeds of 2 domestic cultivars and 24 germplasm releases.

The figure on this page shows the growth of the USDA Collection and the annual sample distribution since 1991 when the Northern and Southern Collection were consolidated into the single collection housed in Urbana. Over the past 20 years, the USDA Collection has an average distribution of 24,038 seed packets per year while the average size of the Collection during that time is only 19,341 accessions.

In 2010, only 4 other collections within the NPGS distributed more than 50% of the number of their accessions and the next highest percentage was 86%. By comparison, we distributed 127%. During the past 10 years those average distributions have risen to 30,175 while the average size of the Collection has increased to 20,713. During the past 15 years, we have distributed seeds of 99% of the accessions in collection. More than 75% of the 211 accessions that have not been distributed are perennial *Glycine*, and the remaining are accessions recently added to the Collection. The most requested accession is the old cultivar Peking, the first widely used source of soybean cyst nematode (SCN) resistance. It has been requested 607 times. Only two other accessions have been requested more than 500 times. Williams 82, the line recently used to create the first soybean genomic sequence, and PI 88788, currently the most widely used source of SCN resistance in the U.S. There were 26 accessions requested more than 200 times and 18 of those lines are U.S. cultivars. The remaining eight accessions include 6 sources of SCN resistance and the sources of *Rpp1* and *Rpp2*, Asian soybean rust resistance alleles. All of the highly requested cultivars were released more than 20 years ago and some are 75 years old. The most often requested wild soybean line is PI 468916, which was a parent of the

**Distribution from the  
USDA Soybean Germplasm Collection**



population that was used to create the first soybean linkage map using DNA markers. Over 790 accessions have been requested an average of 3 times per year for the past 15 years. Fifty nine percent of the USDA Collection has been requested an average of once per year and 97% of the USDA Collection has been requested more than once during the past 15 years.

During the past 15 years, we have distributed germplasm to over 1,700 users. We try to keep only one contact per laboratory but that may not always be true. Although we keep more detailed records, for this general summary the requestors are divided into six categories: foreign commercial companies, foreign public institutions, domestic commercial companies, domestic institutions, U.S. government agencies, and unaffiliated individuals. Over the past 15 years, 25% of the accessions distributed go outside the United States. Of those foreign distributions 5% went to 58 private companies and 95% of the seed lots went to 239 public institutions. Within the U.S., 76% of the seed lots distributed went to public institutions and 24% to private industry. Slightly more than half of the public distributions go to scientists in USDA-ARS and the remainder to 156 colleges and universities, and 33 other public institutions. Twenty-four percent of the domestic distributions went to 145 commercial companies within the U.S. We had 130 individuals not associated with public institutions or private research companies request seeds but the total number of seed lots sent to these people was only 0.3% of the total. In 2008, there were only 70 countries in the world reporting soybean production greater than 1000 metric tons and 31 U.S. states reporting any soybean production. Over the past 15 years we have sent germplasm to 69 foreign countries and all 50 states in the U.S.

We have established a core collection for *Glycine max* and it was published in Field Crops Research this year (Marcelo F. Oliveira, Randall L. Nelson, Isaias O. Geraldi, Cosme D. Cruz and Jose Francisco F. de Toledo. 2010. Establishing a soybean germplasm core collection. Field Crops Res. 119: 277-289). Using a combination of descriptive, quantitative, and origin data, a core of 1,685 accessions was selected and has been entered into GRIN.

Glen Hartman screened all of the available perennial *Glycine* accessions not yet tested for resistance to *Sclerotinia* stem rot (221) and is in the process of summarizing the data. There are 250 *Glycine* perennial accessions that haven't been tested for resistance to SDS and will be screened in 2011.

In cooperation with Marcelo Oliveira of Embrapa, we have begun a two year evaluation all of the soybean accessions in maturity groups IX and X in northern Brazil.

We are still exploring options of germplasm exchanges and/or collection with South Korea, Japan, and China.

The increasing cost of phytosanitary certificates is becoming a major issue for the National Plant Germplasm System. In the past, the Plant Exchange Office (PEO) has paid for the certificates for international germplasm shipments. Last year the fee for phytosanitary certificates was increased again from \$42 to \$60 per certificate. The PEO estimates that it will cost the NPGS approximately \$37,000 for phytosanitary certificates this year and they can cover \$20,000. We have been and asked have contributed \$1,600 to help cover the difference. Possible long term solutions are being explored.

The SNP genotyping of all of the annual accessions is progressing on schedule. All of the lab work is completed but some accessions will have to be redone. There is potential of data on 46,000 SNP loci.

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As of December 31, 2010, the Collection contained the following entries:

**USDA Soybean Germplasm Collection Inventory**

<b>Annual subcollection</b>	<b>Entries</b>	<b>Perennial species</b>	<b>Entries</b>
Introduced <i>G. max</i>	17041	<i>G. arenaria</i>	5
<i>G. soja</i>	1178	<i>G. argyrea</i>	14
Germplasm releases	185	<i>G. canescens</i>	122
Modern cultivars	523	<i>G. clandestina</i>	88
Old cultivars	208	<i>G. curvata</i>	9
Private cultivars	75	<i>G. cyrtoloba</i>	48
All isolines	599	<i>G. dolichocarpa</i>	3
Color	47	<i>G. falcata</i>	29
<u>Genetic types</u>	<u>197</u>	<i>G. latifolia</i>	44
<b>Annual sub-total</b>	<b>20053</b>	<i>G. latrobeana</i>	7
		<i>G. microphylla</i>	32
		<i>G. peratosa</i>	7
		<i>G. pescadrensis</i>	68
		<i>G. pindanica</i>	4
		<i>G. rubiginosa</i>	37
		<i>G. stenophita</i>	27
		<i>G. syndetika</i>	5
		<i>G. tabacina</i>	143
		<i>G. tomentella</i>	310
		<u><i>G. sp.</i></u>	<u>1</u>
		<b>Perennial subtotal</b>	<b>1004</b>

1

**Collection total        21057**

**Number of accessions screened for which data is entered in GRIN:**

<b>Perennial <i>Glycine</i></b>		
<b>Type</b>	<b>Descriptor</b>	<b>Accessions screened</b>
	Core subset	116
	Image	956
CHEMICAL	Bowman-Birk Inhibitor	553
CYTOLOGIC	Chromosome number	759
DISEASE	Sclerotinia stem rot	777
DISEASE	Sudden death syndrome	758
MORPHOLOGY	Adventitious roots	330
MORPHOLOGY	Leaflet arrangement	299
MORPHOLOGY	Upper pubescence type	299
MORPHOLOGY	Upper terminal leaflet length	271
MORPHOLOGY	Upper terminal leaflet shape	299
MORPHOLOGY	Upper terminal leaflet width	299
NEMATODE	Soybean cyst nematode, race 3	493

<i>Glycine max</i>		
Type	Descriptor	Accessions screened
	Core Subset	1685
Chemical	Arginine	5530
Chemical	Cysteine	5530
Chemical	human allergen P34	13267
Chemical	Iodine number	2817
Chemical	Isoleucine	5530
Chemical	Leucine	5530
Chemical	Linoleic	16521
Chemical	Linolenic	16520
Chemical	Lysine	5530
Chemical	Methionine	7069
Chemical	Oil	16625
Chemical	Oleic	15803
Chemical	Other fatty acid composition	5720
Chemical	Palmitic	15803
Chemical	Petiole ureide	2499
Chemical	Protein	16625
Chemical	Stachyose	5522
Chemical	Stearic	15803
Chemical	Sucrose	5483
Chemical	Threonine	5530
Chemical	Tryptophan	5530
Chemical	Valine	5530
Disease	Bacterial pustule	3438
Disease	Bean pod mottle virus	424
Disease	Brown stem rot	4027
Disease	Frogeye C-32 isolate	1688
Disease	Frogeye race 2	2665
Disease	Frogeye, unspecified race	115
Disease	Northern stem canker	1489
Disease	Peanut mottle virus	2150
Disease	Phytophthora rot, race 1	9988
Disease	Phytophthora rot, race 10	629
Disease	Phytophthora rot, race 12	646
Disease	Phytophthora rot, race 17	2235
Disease	Phytophthora rot, race 2	433
Disease	Phytophthora rot, race 20	659
Disease	Phytophthora rot, race 25	2844
Disease	Phytophthora rot, race 3	2826
Disease	Phytophthora rot, race 30	115
Disease	Phytophthora rot, race 30T	263
Disease	Phytophthora rot, race 31	145
Disease	Phytophthora rot, race 33	113
Disease	Phytophthora rot, race 38	65
Disease	Phytophthora rot, race 4	1478
Disease	Phytophthora rot, race 5	798
Disease	Phytophthora rot, race 6	139
Disease	Phytophthora rot, race 7	2980
Disease	Phytophthora rot, race 8	149
Disease	Phytophthora rot, race 9	96
Disease	Pythium ultimum	1290
Disease	Southern stem canker	120
Disease	Soybean mosaic virus	15

<i>Glycine max</i>		
Type	Descriptor	Accessions screened
Disease	Soybean rust, mixed	437
Disease	Soybean rust, red-brown	103
Disease	Soybean rust, tan	3099
Disease	Soybean sudden death syndrome	6859
Growth	Height	16195
Growth	Stem termination type	17441
Insect	Beet armyworm	5
Insect	Corn ear worm	27
Insect	Leaf hopper injury	784
Insect	Mexican bean beetle damage	5049
Insect	Soybean aphid resistance	2600
Insect	Soybean looper	2335
Insect	Velvetbean caterpillar	133
Morphology	Branching	2151
Morphology	Early shattering score	14779
Morphology	Flower color	17570
Morphology	Hilum color	17588
Morphology	Image	1850
Morphology	Late shattering score	12243
Morphology	Lodging	16040
Morphology	Lower leaflet ration	15
Morphology	Mottling score	13016
Morphology	Other leaf traits	969
Morphology	Other plant traits	257
Morphology	Other seed traits	3473
Morphology	Pod color	17559
Morphology	Pod length	15
Morphology	Pubescence color	17711
Morphology	Pubescence density	17654
Morphology	Pubescence form	17196
Morphology	Seed coat color	17746
Morphology	Seed coat luster	17410
Morphology	Seed quality	16198
Morphology	Seed shape of <i>Glycine max</i>	8159
Morphology	Seed weight	16202
Morphology	Stem termination score	11145
Morphology	Upper leaflet length	15
Morphology	Upper leaflet shape	15
Nematode	Cyst nematode, race 1	216
Nematode	Cyst nematode, race 14	2493
Nematode	Cyst nematode, race 2	214
Nematode	Cyst nematode, race 3	12097
Nematode	Cyst nematode, race 4	7379
Nematode	Cyst nematode, race 5	11227
Phenology	Flowering	16204
Phenology	Maturity date	16378
Phenology	Maturity group	17760
Phenology	Twining date	14
Production	Yield	16021
Root	Root fluorescence	796
Stress	Chlorosis score	1974
Stress	High temperature	520
Stress	Salt reaction	564

<i>Glycine soja</i>		
Type	Descriptor	Accessions screened
Chemical	Human allergen P34	1116
Chemical	Linoleic	1075
Chemical	Linolenic	1075
Chemical	Oil	1075
Chemical	Oleic	1075
Chemical	Other fatty acid composition	182
Chemical	Palmitic	1075
Chemical	Protein	1075
Chemical	Stearic	1075
Disease	Bean pod mottle virus	116
Disease	Phytophthora rot, race 3	448
Disease	Soybean mosaic virus	182
Disease	Height	182
Disease	Stem termination type	258
Insect	Beet armyworm	425
Insect	Soybean looper	379
Insect	Velvetbean caterpillar	408
Morphology	Flower color	1008
Morphology	Hilum color	1037
Morphology	Image	1074
Morphology	Leaflet shape	1060
Morphology	Leaflet size	1060
Morphology	Lower leaflet area	1041
Morphology	Lower leaflet aspect	1049

<i>Glycine soja</i>		
Type	Descriptor	Accessions screened
Morphology	Lower leaflet ratio	182
Morphology	Other leaf traits	38
Morphology	Other plant traits	3
Morphology	Other seed traits	300
Morphology	Pod color	1005
Morphology	Pod length	182
Morphology	Pubescence color	1003
Morphology	Pubescence density	1002
Morphology	Pubescence form	450
Morphology	Seed coat color	1041
Morphology	Seed coat luster	572
Morphology	Seed shape	185
Morphology	Seed weight	182
Morphology	Upper leaflet length	182
Morphology	Upper leaflet shape	182
Nematode	Cyst nematode, race 1	1078
Nematode	Cyst nematode, race 3	545
Nematode	Cyst nematode, race 4	1
Nematode	Cyst nematode, race 5	547
Phenology	Flowering	1076
Phenology	Maturity date	1076
Phenology	Maturity group	1007
Phenology	Twining date	182
Stress	Chlorosis score	19

**Photos stored in GRIN:**

	Number of Photos	Number of Accessions
<i>G. max</i>	4,286	2,579
<i>G. soja</i>	2,047	1,079
Perennial <i>Glycine</i>	3,048	958