# Sorghum and Millet Germplasm Committee

Hyatt Regency in Dallas, Texas March 28, 2022

# Minutes

The Sorghum and Millet CGC meeting convened at 3:00 p.m. at the Hyatt Regency in Dallas, Texas by Chairman Hugo E. Cuevas. A total of 22 members were present, visitors, Jeff Dahlberg, Peter Bretting, Gary Kinard and Stephanie Green connected via telephone. After introductions, the meeting convened with a presentation by Hugo Cuevas on the roles and responsibilities of the Committee. The chairman suggested the Committee might have a virtual meeting between each SICNA meeting. Later, a presentation was provided by Peter Bretting (National Program Staff) for an overview of the importance and work of the National Plant Germplasm Systems (NPGS). The highest priorities of NPGS are: 1) acquisitions, maintenance, regeneration, distribution, and documentation and data management.

Stephanie Greene, from the National Laboratory for Genetic Resource Preservation (NLGRP), provided a report of the sorghum and millet germplasm that is still in pre-quarantine. A total of 104 accessions of pearl millet, 279 accessions of finger millet, 6 accessions of proso millet and 73 accessions of sorghum are in pre-quarantine waiting for the permission from Animal and Plant Health Inspection Service (APHIS) to be regenerated and evaluated at St. Croix. Once this germplasm obtains APHIS’s final approval, it will be available to the research community.

Melanie Harrison, a sorghum germplasm curator at USDA-ARS, Griffin, GA, couldn’t attend the meeting because her flights were delayed, therefore, the chairman presented her report at the meeting. Currently, 92% and 95% of the sorghum and S9 millet germplasm collections are available, respectively. Also, 94% and 99% of the sorghum and S9 millet collections, respectively, are backed up at Fort Collins, Colorado. Most of the germplasm requests are from foreign non-commercial organizations and researchers from U.S state agencies and universities. The ten recombinant inbred lines populations that constitute the nested association mapping are available for distribution. These seeds are stored at 4C and its regeneration is under the responsibility of the sorghum community. The sorghum association panel (SAP) is still a high germplasm request, and the inventory is getting lower with some accessions depleted. The sorghum community will increase the SAP periodically in coordination with Melanie Harrison.

Dr. Richard Boyles will provide seeds for the SAP, but Bill Rooney and Chad Hayes also commented that they can grow the SAP for their re-generation. The sorghum community was encouraged to share their germplasm evaluation using the GRIN-Global platform to support the NPGS germplasm program.

Doreen Ware, USDA-ARS, Cold Spring Harbor Laboratory, provided an update on the SorghumBase. The platform had its first release in 2021, release 3 includes 13 sorghum genome references that represent cultivated sorghum and wild relatives. Genetic variation is available for 499 sorghum accessions, with 13 million naturally occurring SNPs, and is presented in context to

the gene annotations. The gene trees were constructed from reference sorghum genomes and 7 additional species, including maize and rice to support transfer of functional information across species. The feedback from the members of the committee included the prioritization of establishing a standard phenotyping dataset for the different core community germplasm collections such as the nested association mapping populations and the sorghum association panel. Jeff Dalberg suggested we continue to use the sorghum descriptors for standard germplasm phenotyping. Since the sorghum descriptors involve multiple traits, it was suggested to limit the phenotyping characterization to five traits that have high heritability and breeding value.

The actual limitation of the NPGS sorghum germplasm collection is its tropical origin (i.e. photoperiod sensitive). The large size of the collection makes it impossible convert the whole collection to be adapted to temperate adapted regions. Jeff Dahlberg suggested the use of genome editing (CRISPR) which might be an alternative in the near future. Bill Rooney suggested that the use of genomic prediction is the most adequate approach to identify and select the most valuable germplasm in the collection. The establishment of a sorghum community genotyping service with an agreement with a private service provider might aid to reduce the cost of the genotyping. The establishment of a sub-committee to develop a community marker panel for breeding programs and germplasm characterization was suggested.

Respectfully submitted,

HUGO CUEVAS

Hugo E. Cuevas

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CGC Sorghum and Millet Chairman

# Attendance list Sorghum and Millet Germplasm Committee meeting

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Affiliation** | **Name** | **Affiliation** |
| Sarah Sexton-Bowser | K-State CSI | Logan Hopper | Scott Seeds |
| Earl Romer | Nu Life Market | Cucit Gonzalo | Nu seed |
| Darshna Uyas | LGC Genomics | Gabriel Krishnamoorthy | Richardson Seeds |
| Prasad Siddavatam | LGC Genomics | Breat Bean | USCP |
| Yves Emendack | USDA-ARS;  Lubbock, TX | Doreen Ware | USDA-ARS; Cold Spring Harbor, NY |
| Noah Winans | Texas A&M | Rammassamy Perumal | K-State |
| Fabian Leon | Texas A&M | Chad Hayes | USDA-ARS; Lubbock, TX |
| Kayla Bechinor | Texas A&M | Hugo Cuevas | USDA-ARS; Mayaguez, PR |
| Mitchel Kart | Texas A&M | Jeff Dahlberg | Retired |
| Terry Felderhoff | K-State | Patricia Klein | Texas A&M/ AgriLife Research |
| Chris Little | K-State | \*Stephanie Greene | USDA-ARS; Fort Collins, CO |
| Shelley Meiwes | Richardson Seeds | \*Karen Harris | USDA-ARS; Tifton, GA |
| Jody Gelchrest | Warners Seeds | \*Dipak Santra | University of Nebraska, Lincoln, NE |
| William Rooney | Texas A&M | \*Gary Kinard | USDA-ARS; Beltsville, MD |
| Chuck Cielencki | Scott Seeds | \*Peter Bretting | USDA-ARS; Beltsville, MD |

\* virtual participation

**REPORT TO THE SORGHUM and MILLET CROP GERMPLASM COMMITTEE**

**March 28, 2022**

**Melanie L. Harrison, Sorghum & S9 Millet Curator**

STATUS OF THE COLLECTION

There are 17 taxa included in the S9 millet collection with 2430 total available accessions (Table 1). Most of these accessions are pearl millet (Cenchrus americanus) with 1315 accessions. The sorghum collection continues to be the largest crop collection maintained at the Griffin, GA location with 47,458 accessions (Table 2). Currently, 92% of the sorghum accessions and 95% of the S9 millet accessions are available for distribution (Table 2). Ninety-four percent of the sorghum germplasm and 99% of the S9 millet germplasm is backed up at the National Laboratory for Genetic Resources Preservation (NLGRP) in Fort Collins, CO. Germplasm backed up at the Global Seed Vault in Svalbard, Norway includes 9358 accessions of sorghum and 934 accessions of S9 millets.

**Table 1.** List of species included in the maintenance group S9 Millets curated at Griffin, GA.

|  |  |
| --- | --- |
| **Taxon** | # **Accessions** |
| **Cenchrus americanus** | 1315 |
| **Cenchrus sieberianus** | 7 |
| **Digitaria exilis** | 1 |
| **Eleusine coracana** | 736 |
| **Eleusine coracana subsp. africana** | 2 |
| **Eleusine floccifolia** | 1 |
| **Eleusine indica** | 5 |
| **Eleusine intermedia** | 1 |
| **Eleusine multiflora** | 2 |
| **Eleusine tristachya** | 5 |
| **Panicum schinzii** | 7 |
| **Paspalum scrobiculatum** | 336 |
| **Paspalum scrobiculatum var. bispicatum** | 2 |
| **Cenchrus schweinfurthii** | 2 |
| **Urochloa deflexa** | 1 |
| **Urochloa ramosa** | 4 |
| **Urochloa texana** | 1 |
|  |  |
| **TOTALS** | **2430** |

**Table 2.** Status of the USDA Sorghum and S9 Millet Germplasm Collection as of December 30, 2021

|  |  |  |
| --- | --- | --- |
|  | **Sorghum** | **S9 Millets** |
| **Total Number of Taxa** | 22 | 17 |
| **Total Number of Accessions** | 47458 | 2428 |
| **Number of Available Accessions** | 43780 | 2306 |
| **Number of Unavailable Accessions** | 3678 | 122 |
| **Number of Accessions Backed Up** | 44573 | 2401 |
| **Svalbard Back Up** | 9358 | 934 |
| **Number of Accessions at -18C** | 43173 | 2428 |
| **Number of Viability Tests** | 41756 | 2412 |

DISTRIBUTIONS

For the 2021 calendar year, 15,294 accessions of sorghum germplasm, including genetic stocks, were distributed. A total of 2640 accessions of S9 millets were distributed (Table 3).

**Table 3**. Distributions of sorghum and S9 millet germplasm during the 2021 calendar year.

|  |  |  |  |
| --- | --- | --- | --- |
| **Cooperator Affiliation** | **Number of Accessions Sorghum** | **Number of Accessions S9 Millets** | **Number of Accessions Sorghum Genetic Stocks** |
| Foreign commercial category | 1909 | 121 | 60 |
| Foreign genebank | 0 | 0 | 0 |
| Foreign individual no affiliation | 0 | 22 | 0 |
| Foreign non-commercial organization | 3846 | 1231 | 1357 |
| U.S. state agencies and all universities | 3260 | 1226 | 973 |
| Agricultural Research Service | 1845 | 0 | 14 |
| U.S. commercial company | 204 | 11 | 67 |
| U.S. individual no affiliation | 20 | 26 | 0 |
| U.S. non-profit organizations | 955 | 3 | 681 |
| U.S. federal agency (not AID or ARS) | 103 | 0 | 0 |
| **Total Distributions** | **12142** | **2640** | **3152** |

REGENERATION AND MAINTENANCE

Regenerations of sorghum and pearl millet continued to be performed in Puerto Rico in collaboration with the USDA, ARS, Tropical Agriculture Research Station. Regenerated seed are sent back to Griffin, GA for processing into the collection. Each regeneration sample has a germination test prior to storage. All newly regenerated accessions are split into two inventories - a 500 seed sample for long term -18C storage and the remaining seed at 4C for distributions. If the current backup inventory at Fort Collins, CO has low germination or seed quantity, a new backup inventory is sent from the newly regenerated seed.

ACQUISITIONS

Ten nested associated mapping (NAM) populations were donated by Kansas State University to the collection. These subsets are included in the Sorghum Genetic Stocks collection and are identified as follows: NAM\_RTX430 x Ajabsido; NAM\_RTX430 x SC971; NAM\_RTX430 x Macia; NAM\_RTX430 x Segaolane; NAM\_RTX430 x P898012; NAM\_RTX430 x SC1103; NAM\_RTX430 x SC1345; NAM\_RTX430 x SC265; RIL BTX623 X IS3620C; and NAM\_RTX430 x SC283. The populations are

defined by the descriptor “subset of a population” and can therefore be found using the descriptor search feature on GRIN-Global (https://npgsweb.ars-grin.gov/gringlobal/descriptors). Accessions of these populations are maintained at 4C only and do not have an additional sample at -18C. Seed will be distributed until the sample is exhausted and not regenerated.

NEEDS

The Sorghum Association Panel (SAP) continues to be requested and remains a popular set of germplasm for research. Quantities of some SAP inventories are low with many depleted. Since this material is not regenerated by the NPGS, donations of additional seed for this group are needed in order to continue distributions.

Accession level data is very valuable for the collection. Once a study is published, if the researcher could please share the accession level data with the NPGS, the data can be uploaded to GRIN-Global. Information on the study, including the manuscript citation, can be included in the narrative that is associated with the data on GRIN-Global. Thus, the citation be shared with a broader audience and increase the value of the manuscript as well as the data available on GRIN-Global.

**We kindly request for authors to include the USDA, ARS, NPGS in the acknowledgement section for all manuscripts where NPGS germplasm is used.**

ACKOWLEDGEMENTS

Thanks to Nick Stigura (USDA-ARS, IT Specialist) for providing the data for this report and to Tiffany Fields (USDA-ARS, Seed Storage Manager) for oversight of the sorghum seed cleaning, processing, and distribution activities at the Griffin, GA location.

Thanks also to the PGRCU seed storage team (Jill Cunningham, Sylvia Jones, Cassa Munroe, and Phiffie Vankus) for their assistance in sorghum distributions and seed processing.

# Sorghum and Millet CGC

**National Laboratory for Genetic Resource Preservation (NLGRP) Report 2022**

Stephanie L. Greene, Seed Curator (stephanie.greene@usda.gov)

The NLGRP, in Fort Collins, CO is a part of the National Plant Germplasm System (NPGS). We provide long- term storage of safety duplicate collections for the NPGS and non-NPGS germplasm collections. Most seed material is stored at -18  C; short-lived seed is stored in liquid nitrogen vapor. Clonal material is stored in liquid nitrogen. We conduct research on seed longevity, cryopreservation, and germplasm acquisition, especially crop wild relatives.

Sorghum and millet activities at NLGRP

* Dr. Ricardo Goenaga will be receiving final approval from APHIS to permit grow outs of quarantined material at St. Croix. Once this occurs, we can complete the quarantine processing for the remaining millet and sorghum (462 accessions) we hold in pre-quarantine storage.

Table 1. Millet and sorghum in pre-quarantine storage at NLGRP

|  |  |  |
| --- | --- | --- |
| Taxon | N | Country |
| Cenchrus americanus | 25 | Algeria (1), India (3), Malawi (14), Oman (3), Senegal (1), Sudan (1), Zimbabwe (2) |
| Cenchrus flaccidus | 2 | China (2) |
| Cenchrus geniculatus | 1 | Zimbabwe (1) |
| Cenchrus lanatus | 1 | Pakistan (1) |
| Cenchrus orientalis | 1 | Turkmenistan (1) |
| Cenchrus polystachios | 7 | Burundi (6), DR Congo (1) |
| Cenchrus purpureus | 8 | Burundi (1), Oman (1), Zimbabwe (6) |
| Cenchrus sieberianus | 19 | Mali (10), Niger (9) |
| Cenchrus sphacelatus | 1 | Lesotho (1) |
| Cenchrus spp. | 24 | Botswana (1), Burundi (1), Sudan (22) |
| Cenchrus trachyphyllus | 1 | DR Congo (1) |
| Cenchrus violaceus | 14 | Mali (2), Niger (12) |
| Eleusine coracana | 279 | DR Congo (7), Kenya (261), Nepal (4), Nigeria (1), Saudi Arabia (1), Taiwan (1),  Yemen (4) |
| Panicum miliaceum | 6 | Kazakhstan (1), Kenya (1), Nepal (3), Russia (1) |
| Sorghum bicolor | 24 | China (1), Liberia (1), Malawi (2), Nigeria (1), Somalia (6), South Africa (1), Sudan (2),  Tanzania (1), Zambia (5), Zimbabwe (4) |
| Sorghum hybr. | 1 | Niger (1) |
| Sorghum plumosum | 12 | Australia (12) |
| Sorghum purpureosericeum | 2 | Chad (2) |
| Sorghum spp. | 3 | Burundi (2), Tajikistan (1) |
| Sorghum stipoideum | 15 | Australia (15) |
| Sorghum timorense | 15 | Australia (15) |
| Sorghum versicolor | 1 | Zimbabwe (1) |

* NLGRP scanned over 30,000 storage information forms and documents (e.g. variety brochures, PVP applications, etc). We are wrapping up our quality check, and will be uploading to GRIN attached to specific accessions. These efforts will enhance the documentation available in GRIN to describe our germplasm, including sorghum and millet.
* Ninety-two percent of the NPGS sorghum and millet collection is duplicated at NLGRP. Material is stored at -18 C.