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Sorghum is the fifth most important cereal in the world. Grows, mainly in semi-arid tropics and subtropics, with an annual production of 56.5 million tons from 41.5 million ha in 99 countries (<http://faostat.fao.org/>). The genus *Sorghum* belongs to family *Poaceae* subfamily *Panicoideae* and tribe *Andropogoneae*. Soaring prices of fossil-fuels and resulting environmental pollution has increased worldwide interest in biofuels as an alternative source of energy.

Through its pro-poor BioPower Initiative, ICRISAT has identified sorghum as a promising bioenergy crop. Sorghum yields eight times more energy in the form of bioethanol than is consumed for its production, thus empowering dryland farmers to fight against climate change. Sweet sorghum is similar to grain sorghum but with a sugar-rich stalk. Stalk juice is used to produce bioethanol, and the residue is nutritious and good for livestock feed.

## World collection of sorghum germplasm

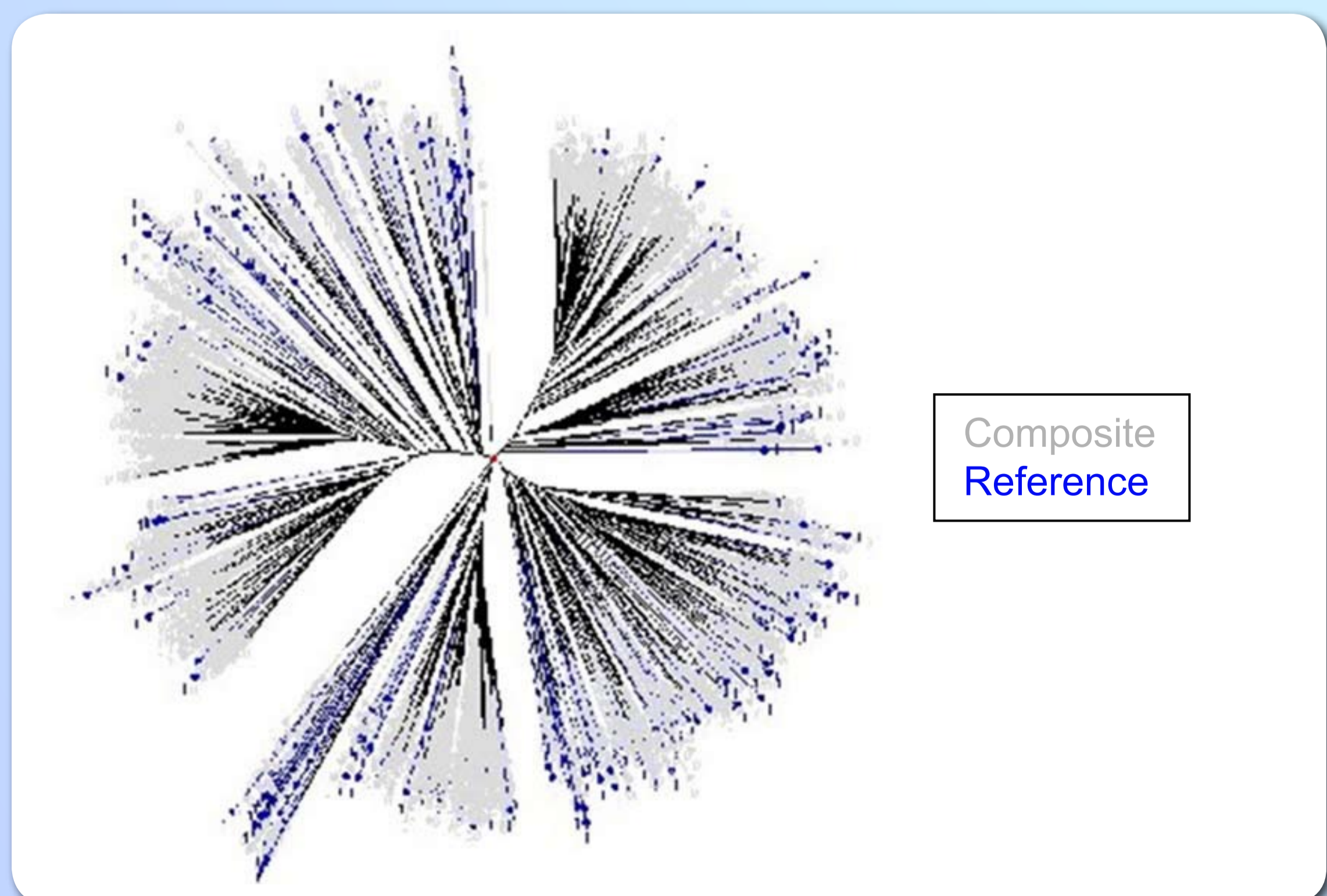
Globally, there are 194,899 accessions of sorghum. Approximately 62% are maintained in 20 national and international genebanks. ICRISAT genebank has 37,904 accessions from 91 countries.



Genetic variability for panicle and grain characteristics.

## Developing genotyping-based reference set

ICRISAT developed a composite collection of sorghum consisting of 3367 accessions, selected from 33,100 accessions, molecularly profiled using 41 SSR. A reference set of 384 diverse accessions representing 78% (615 of the 789 alleles) allelic diversity of the composite collection extracted (<http://www.generationcp.org>). All five major races and ten intermediate races are represented in this reference set. Included in this are also 23 wild sorghum accessions from 5 species.



Distribution of reference set representing sorghum global composite germplasm diversity.

## Evaluating reference set for sugar content

Three hundred seventy-five accessions along with three controls (IS 33844, 2205 and 18758) were grown in a replicated trial during the 2007/2008 post-rainy season at Patancheru, India. The main sorghum-stalk at 40 days after anthesis was sampled (4th internode) from each plot, juice extracted, and sugar content determined.



Extracting juice from sorghum stalk.

## Genetic variation for sugar content

- 3.8% to 21.0%, averaged 11.2%
- Controls: 9% to 15%
- 43 accessions with similar or high sugar content than IS 18758 (15-21%)
- Diversity in races: five basic races and three intermediate races

### Race diversity among high sugar content sorghum accessions

Race	Number of accessions	Range (Sugar content %)
Bicolor	2	15 - 17
Guinea	5	15 - 16
Caudatum	18	15 - 21
Kafir	1	15
Durra	6	15 - 17
Guinea-Caudatum	5	15 - 17
Caudatum-bicolor	3	15
Durra-bicolor	3	15 - 21

## Perspective and issues involved in utilization of germplasm for developing sorghum varieties/hybrids for food, feed and bioethanol

- Genotype by environment interaction for sugar content
- Yield penalty when selecting for high sugar content
- Variation in stalk sugar content and susceptibility to pest and diseases
- Selecting for high stalk sugar content, high grain yield and biomass production
- Selecting for biomass with lower lignin content for production of ethanol from sorghum stover.

<sup>1</sup> SP1 Project G3005.01.03: Completing genotyping of composite germplasm set of sorghum