SUGARCANE BREEDING INSTITUTE RESEARCH CENTRE, KANNUR

Profile

Sugarcane Breeding Institute

(Indian Council of Agricultural Research)
Coimbatore - 641 007

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Introduction

Fig 1. A view of field gene bank

Sugarcane Breeding Institute - Research Centre, Kannur is a constituent unit of Sugarcane Breeding Institute, Coimbatore which is one of the crop research Institutes under Indian Council of Agricultural Research. This centre houses the world collection of sugarcane germplasm. The world collection of sugarcane germplasm was originally established at Canal point, Florida, USA. The need for duplicating the collection in another location was felt and based on the resolution of International Society of Sugarcane Technologists (ISSCT) in 1956, the Sugarcane Breeding Institute, Coimbatore was recognized as another centre for world collection of sugarcane germplasm. The seed material of the entire world collection at Canal point was airlifted during 1957-58 to Coimbatore and were initially maintained at the Agricultural Research Station, Thaliparamba, in Kannur District, Kerala. In 1961, a research centre of Sugarcane Breeding Institute was established at Kannur (formerly known as Cannanore), Kerala as the West Coast Regional Centre of Sugarcane Breeding Institute and the collection maintained at Thaliparamba was shifted to Kannur. At present the centre houses the largest collection of *Saccharum* species germplasm and is an IPGRI designated field gene bank of sugarcane.

Fig 2. Field Gene bank - another view

Mandate

- Maintenance of world collection of sugarcane germplasm
- Developing varieties resistant to waterlogging
- Utilization of germplasm resources for developing new genetic stocks

Sugarcane Gene Bank

The present day cultivated varieties of sugarcane are man made hybrids involving *Saccharum officinarum, S. spontaneum, S. barberi, S. sinense* and to a limited extent *S. robustum*. *S. officinarum* is the thick, soft high sugared tropical sugarcane which is also known as the 'noble' cane. *S. barberi* and *S. sinense* are the north Indian and

Fig 3. Indian hybrids in bloom

Fig 4. *Sclerostachya*

Chinese forms respectively, which were under cultivation in the sub-tropical areas before the advent of the man made hybrid varieties in the early part of twentieth century. At present these varieties are not commercially cultivated and are available in the germplasm collections maintained by research stations. *S. spontaneum* is a wild weedy grass with wide distribution and *S. robustum* is another wild species with limited distribution in New Guinea and adjoining Indonesian islands. The related genera of *Saccharum* such as *Erianthus, Miscanthus, Narenga and Sclerostachya* are also considered to be useful in sugarcane genetic improvement. The natural habitats of wild sugarcanes and related grasses were disturbed and traditionally grown sugarcane varieties were replaced by new man made hybrids. Organized collection and conservation of cultivated and wild

Fig 5. *Erianthus longisetosus*

canes are required as the sources of genes for yield, quality and resistance to diseases, pests and abiotic stress factors. The germplasm assembly at SBI Research Centre, Kannur now consists of 1806 accessions under International collection and 1562 under Indian collection.

International Collection:

Fig. 6. *S.officinarum*

International collection comprises of *S. officinarum* (759), *S. barberi* (42), *S. sinense* (30), *S. robustum* (145), S. spontaneum (67), foreign hybrids (611) and allied genera (152).

Most of the *Saccharum officinarum* and all of the *S. robustum* clones were originally collected from Papua New Guinea and nearby islands of Indonesia through organized expeditions and it includes the *S.edule* clones that were locally cultivated for its edible inflorescence. The foreign hybrids in the collection include historical and commercial man made hybrids. The foreign commercial hybrids represent 24 sugarcane growing countries as listed below.

	Country	No.of clones
1	USA	134
2	Barbados	72
3	Puerto Rico(USA)	58
4	Fiji	53
5	Australia	47
6	Hawaii(USA)	42
7	Indonesia	38
8	Taiwan	27
9	Mauritius	19
10	Brazil	15
11	Columbia	11
12	Guyana	9
13	Cuba	8
14	South Africa	8

Fig 7. *S.edule*

The allied genera include a large number of *Erianthus arundinaceus* clones from New Guinea and Indonesia collected during 1976 and 1977.

Indian collection: Indian collection comprises Indian hybrids (1027), allied genera and others (88), *S.spontaneum* (317) and IA clones (130). Indian historical and commercial hybrids consists of mainly Co canes developed at Sugarcane Breeding Institute, Coimbatore and clones released by other Research Centres in the century viz., Jullundur, Lyallpur, Shahjahanpur, Pusa, Mandya, Lucknow, Karnal, etc. Many of these clones are used in breeding programmes in different countries and appear in the pedigree of many of the new commercial hybrids. The IA clones are hybrids between American commercial hybrids and Indian *S. spontaneum* clones. Large number of *S. spontaneum, Erianthus* species and related species collected through expeditions in north-eastern region of the country from 1981 to 1990 are maintained as IND collections.

Fig. 8. IA clones in full bloom

Fig. 9. A *S. spontaneum* clone

The germplasm accessions are clonally propagated every year and are maintained in the field free of major diseases. This is achieved by adopting strict quarantine procedures and regular monitoring for the incidence of pests and diseases. The added advantage of the centre is that it is located in a place where sugarcane and the related crops such as maize and sorghum are not commercially cultivated. The clones obtained from different national and international expeditions are added to the collection after necessary quarantine. The germplasm is supplied on request to sugarcane research stations within the country and are exchanged with other sugarcane growing countries. The clones under different categories were evaluated for various economic characters and catalogues /databases were published on *S. officinarum, S. spontaneum, S. barberi, S. sinense, S. robustum,* Indian hybrids and foreign hybrids by Sugarcane Breeding Institute.

Complimentary strategies for germplasm conservation

The field gene bank is exposed to various diseases and pests and other natural calamities like drought, flooding, etc. Genetic resources being the safe deposit for the present and future crop improvement programmes, it is imperative to maintain the germplasm through whatever mode of conservation available to safeguard it from any kind of loss. Looking in to the threat of various biotic and abiotic stresses that is likely to affect the field maintenance, a complimentary germplasm maintenance strategy has been thought about and tissue culture work was initiated at the Centre to work on *in vitro* regeneration and *in vitro* conservation.

Fig. 10. *In vitro* gene bank

The *in vitro* gene bank will act as an insurance against the various biotic and abiotic stresses affecting the field gene bank. The meristem culture technique coupled with other treatments can be effectively utilized in cleaning up the germplasm already infected with the viral pathogens and can be maintained in a disease free condition. The germplasm material conserved *in vitro* can be supplied irrespective of the crop season. It will also facilitate germplasm exchange with minimum quarantine procedures. The varieties developed by the Institute and other research Centres across the country could not be added to the field Gene bank at Kannur in recent years as most of the varieties are infected by sugarcane mosaic virus. With the establishment of the facility for meristem culture it will be possible to make the clones free of viral infection and add them to the gene bank,

Utilization of germplasm resources for developing new genetic stocks

Interspecific and intergeneric hybridization was taken up at the centre to tap the unutilized genetic resources and the promising genetic stocks identified were provided to breeders for further utilization. Intraspecific improvements of *S.officinarum* and *S.robustum* was brought about through repeated cycles of intraspecific hybridization and selection.

Fig 11. *Erianthus arundinaceus*

Many early high sucrose types were identified from interspecific hybrids involving previously unutilized *S.officinarum* clones as female parent. Intergeneric hybrids involving *Erianthus arundinaceus* with sugarcane commercial hybrids and their backcrosses with sugarcane had red rot resistance indicating that it can be used as a new source of red rot resistance. Repeated back crosses of the hybrids with sugarcane were made and the progeny are under evaluation.

Breeding varieties for water logging resistance

The centre had been conducting research on the development of varieties resistant to water logging. The Indian and foreign hybrid germplasm had been screened under natural conditions of waterlogging and 15 clones have been identified as waterlogging resistant.

Fig. 12. Hybridization

Inter varietal crosses involving elite hybrid clones have been carried out and the progenies were screened under waterlogged conditions to identify resistant clones.

SBI RC Kannur serves as the largest repository for sugarcane genetic resources in the world. The germplasm available represents potential sources for better productivity and resistance to biotic and abiotic stresses. The availability of a large well charecterised germplasm is the major strength of the cane breeding programmes in the country. Systematic utilization of the germplasm in breeding programmes have helped in

developing varieties with better productivity, adaptability and with a broader genetic base.

Fig 13. Evaluation for waterlogging resistance

The promising waterlogging resistant clones developed at this centre include Co 8231, 84 WL 22, Co 96011, Co 96017, Co 96018, Co 98001, Co 98007, Co 99006, Co 99010 and Co 0321. The high sugared and waterlogging tolerant hybrid Co 99006 was registered as a potential germplasm (INGR 08042, IC 556976) by Germplasm Registration Committee of ICAR.

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