Erianthus hybrids introgression to develop commercial sugarcane cultivars

S.Rajeswari, P.Bharathi and Manjunatha S Rao,
Sugarcane Research and Development Centre,
E.I.D.-Parry(India) Ltd., Pugalur,
Tamil Nadu, India

E.I.D.- PARRY (INDIA) LTD



Started 1788 - 226 years

Pioneers in:

- Sugar from 1842 (172 years)
- Distillery from 1848
- Sanitary ware from 1906
- Fertilizers from 1906
- Sugar Based confectionery from 1914
- Biogas and Bio earth 1987
- Bio-pesticides from 1995
- Co-generation Power for GRID from 1997
- Algal Neutraceuticals from 1997
- Branded sugar from 2004

Core Purpose

Enrich life by creating value from agriculture

SOUTH INDIA PRESENCE

murugappa

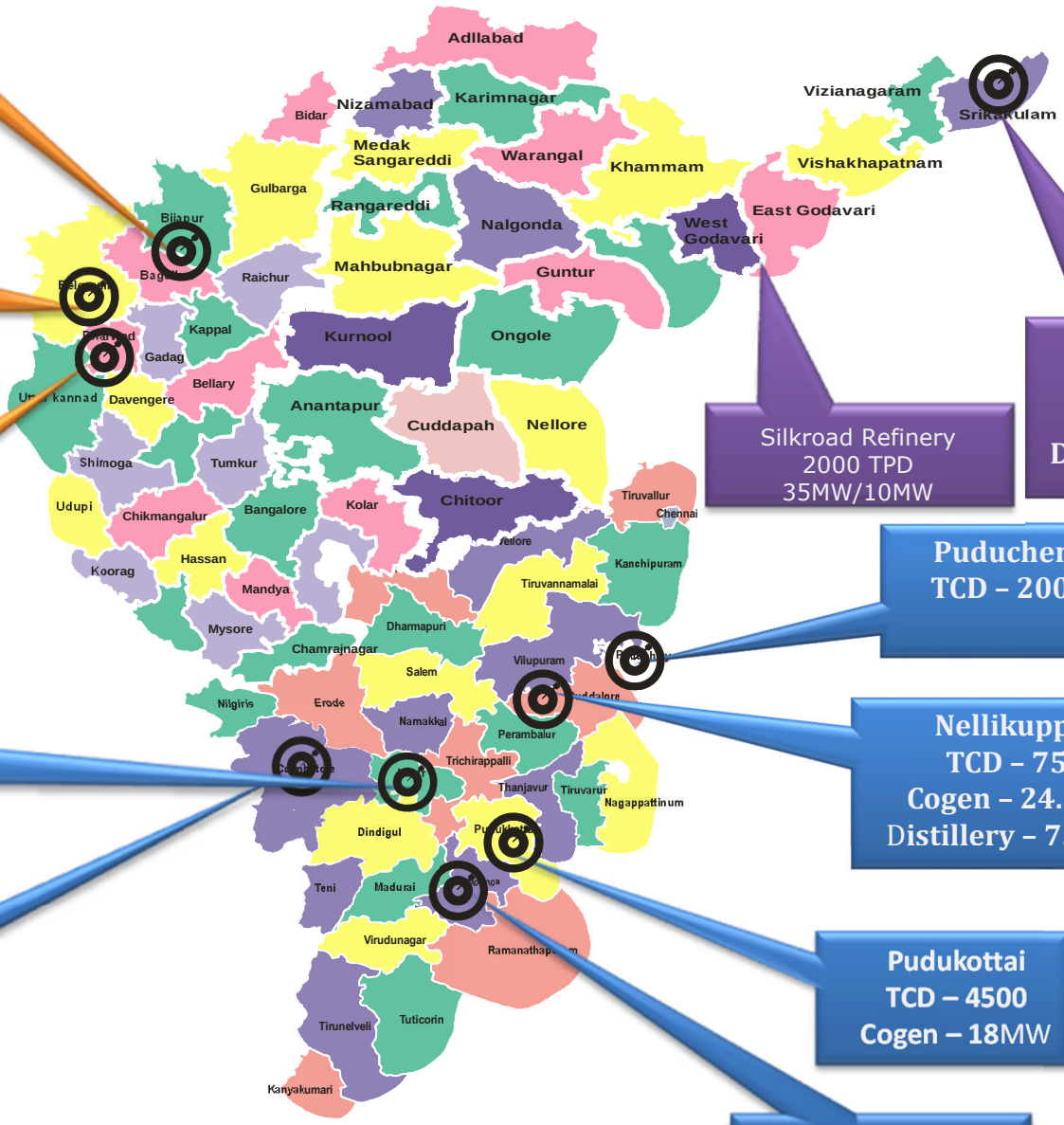
BAGALKOT
TCD – 4750
Cogen – 15 .5MW

HALIYAL
TCD – 6600
Cogen – 24MW
Distillery – 50 KLPD

RAMDURG
TCD – 4000
Cogen – 13 MW

Pettavaithalai
TCD – 4000
Cogen – 20 MW

Pugalur
TCD – 4800
Cogen – 22 MW



Silkroad Refinery
2000 TPD
35MW/10MW

SANKALI
TCD – 5000
Cogen – 16 MW
Distillery – 45 KLPD

Puduchery
TCD – 2000

Nellikuppam
TCD – 7500
Cogen – 24.5 MW
Distillery – 75 KLPD

Pudukottai
TCD – 4500
Cogen – 18MW

Sivaganga
Distillery – 60 KLPD

R&D

BONSUCRO®

Research and Development To Research, Development, Education & Sustainability

Objectives of R&D

- **Crop improvement : Proprietary varieties** Breeding , Tissue culture
- **Crop** production Seed cane management**,** Soil Nutrient and water management,
- **Crop protection –** Bio control agents for pest management (Entomology and Pathology)
- **Technology transfer** , Training and education
- **Sustainability Projects**

Breeding Program (Strategy)

- **Establish a gene pool (Parry germplasm base)**
  - – Germplasm- collection, local and other species (>2395)
  - -- Characterization of germplasm (morphological, biochemical & molecular)
- **Create variability -**
  - -- Identification of Parents,
  - -- Effecting crosses -INTER generic and INTER specific crosses
  - -- Bi parental and poly crosses
- **Initial selection** Seedlings, unreplicated
- **A sound Evaluation and selection program**
  - -- Field trials with suitable designs to select varieties
  - -- Multi-location trials for adaptability and stability
  - -- Demonstration and Farmers' acceptance
- **New Improved variety (Proprietary variety)**
  - -- PI (Parry , India)

Major objectives of this study

1. Broaden the genetic base of Parry sugarcane germplasm through introgression of *Erianthus arundinaceus*

2. Evaluation of intergeneric hybrids through

   - ❑ Phenotypic characters
   - ❑ Molecular markers to confirm its hybridity

3. Develop commercial cultivars to incorporate economic traits (high biomass and sucrose)

Bangalore - Location Advantage

Particulars	Bangalore	Coimbatore
Latitude	77° E	77° E
Longitude	12° N	11° N
Altitude	900 m above msl	427 m above msl
Rainfall	850mm	800mm – 1000mm
Humidity	87% Oct to Jan	85% Oct to Jan



Crossing Program





Crossing shed





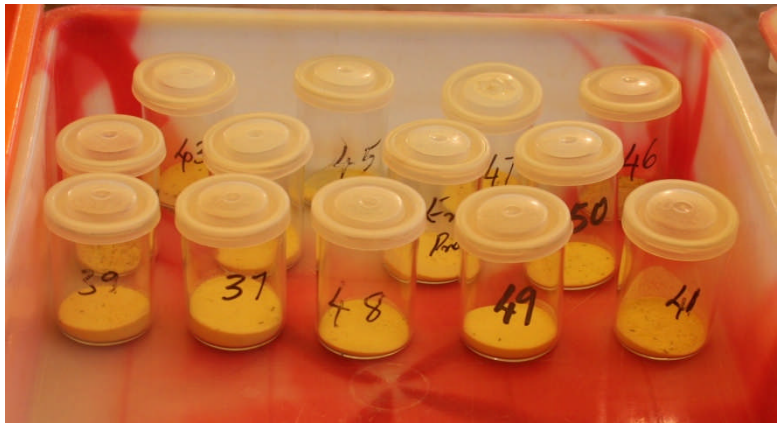


Pollen collection

Crossing Program contd.,

Pollen





Pollination



Seedling Development



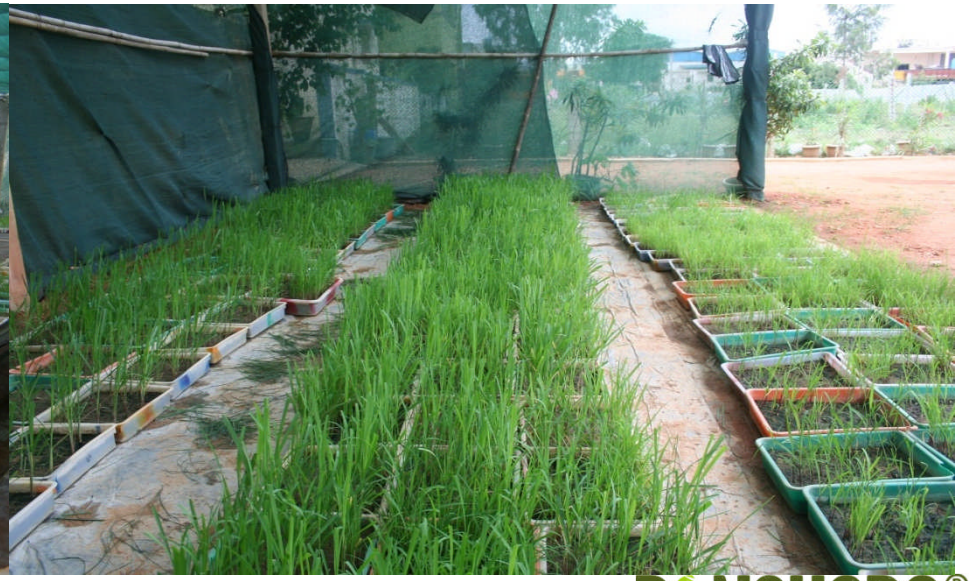
Fuzz for sowing



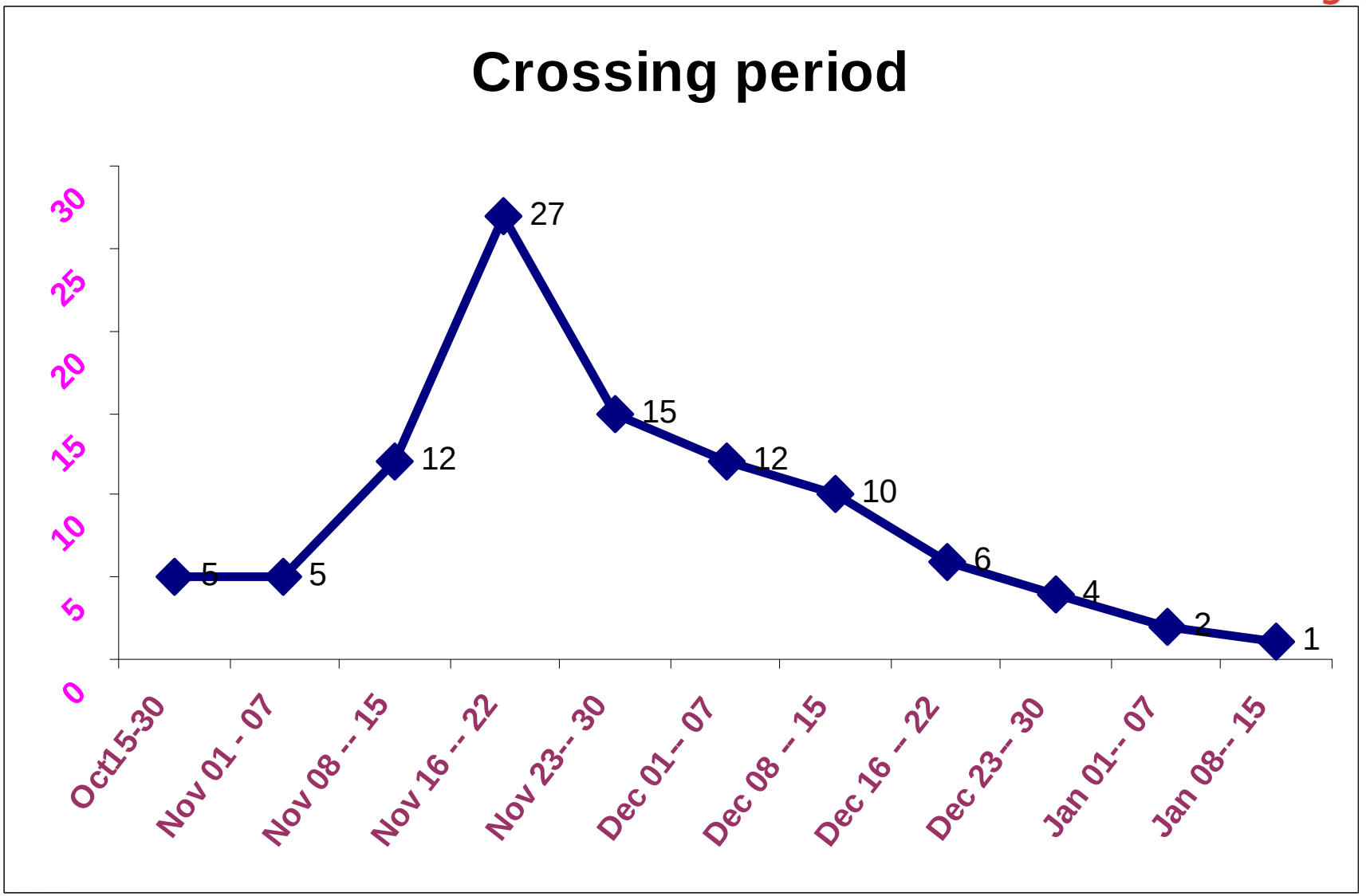
Germinated seedlings



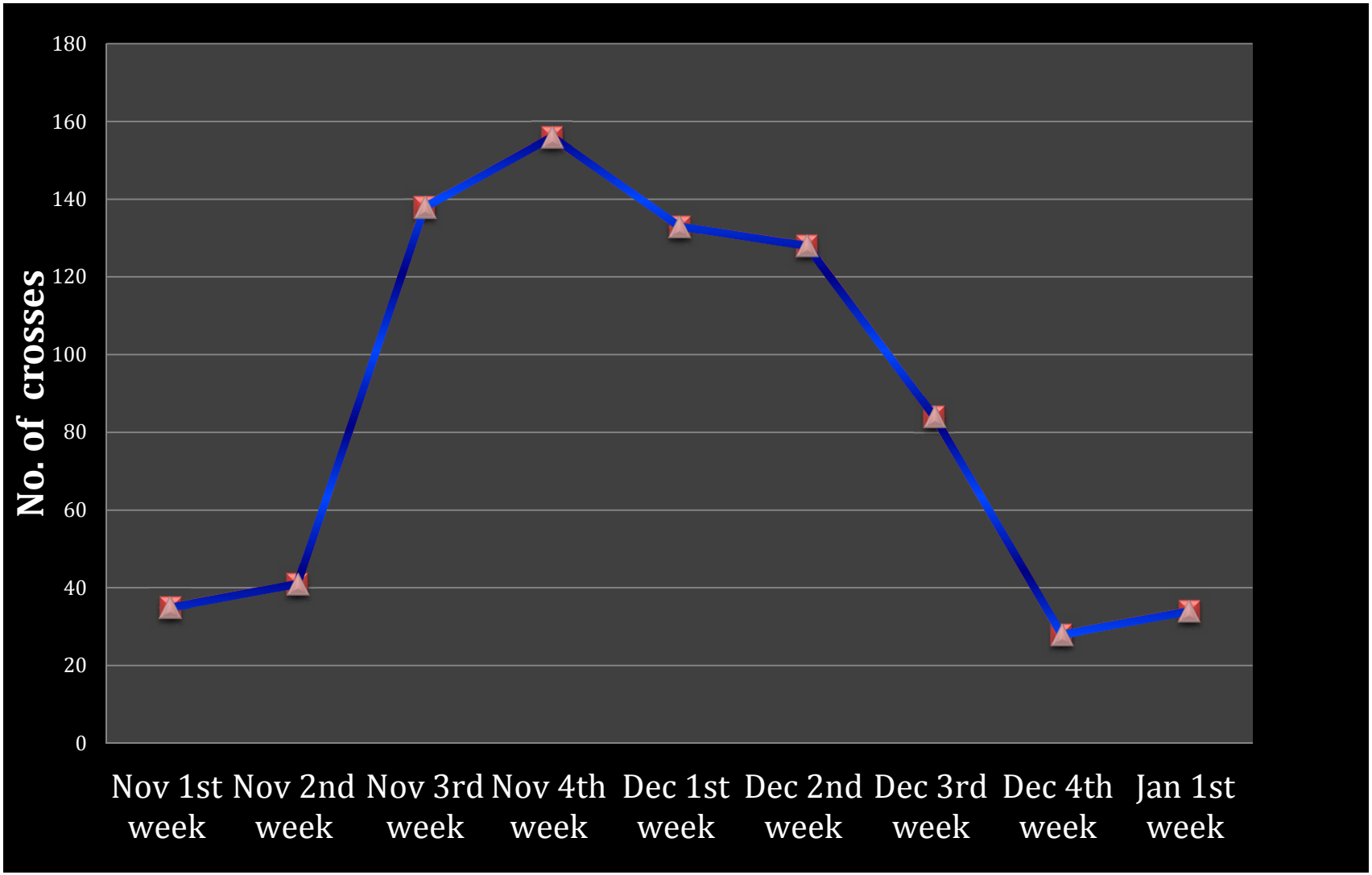
Established seedlings



Seedlings hardening


Crossing period
0
5
10
15
20
25
30
5
5
12
27
15
12
10
6
4
2
1
Oct15-30
Nov 01 - 07
Nov 08 -- 15
Nov 16 -- 22
Nov 23-- 30
Dec 01-- 07
Dec 08 -- 15
Dec 16 -- 22
Dec 23-- 30
Jan 01-- 07
Jan 08-- 15

Week wise crossing details



Process of evaluation

2010 - 11

Developed 26 *Erianthus* hybrids

19 were confirmed as *Erianthus* hybrids through molecular analysis

2011 - 12

10 hybrids utilized in hybridization programme

2012 - 13

Produced 667 Stage I seedlings

HRR Brix and field traits

2013 - 14

Evaluation of Stage II – 30 clones

HRR Brix , Field traits - thick cane, good internode length and more tillers

2014 - 15

Evaluation of Stage III – 9 clones

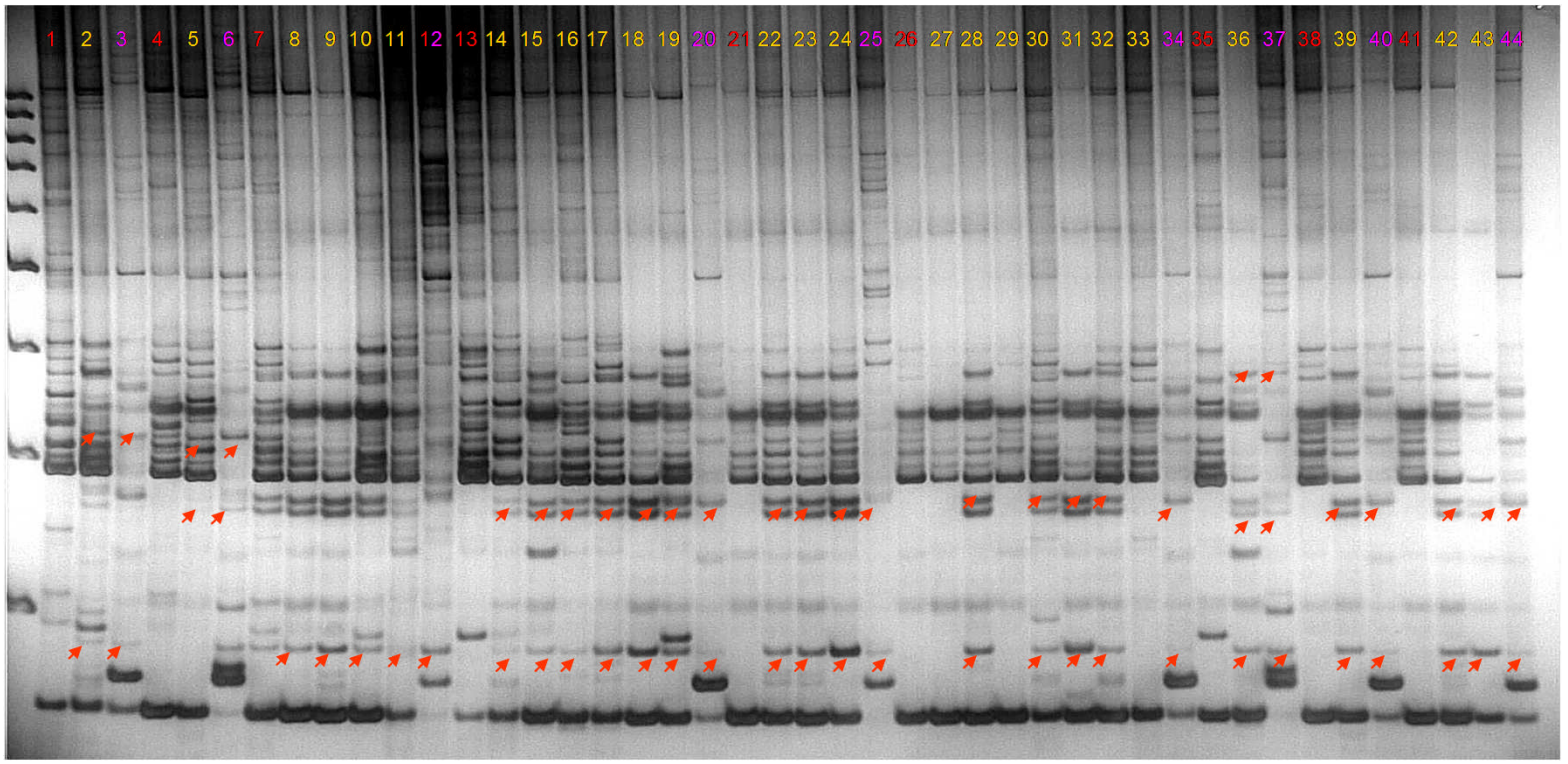
Phenotypic Evaluation of Intergeneric hybrids

Thus the hybrids were selected based on phenotypic characters viz.,

leaf orientations,
self stripping of leaves,
stalk length,
stalk thickness,
inter-node length
stalk colour,
Leaf sheath pubescence
And
HRR Brix



Molecular analysis of hybrids



1- PIO 01-0003	7- PIO 01-0006	13- PIO 01-0022	19- PI 09-0023	25- PIE-A 02-0021	31- PI 09-0011	37- PIEP 97-0001	43- PI 09-0046
2- PI 08-0553	8- PI 09-0153	14- PI 09-0018	20- PIE-A 02-0022	26- PIO 05-0042	32- PI 09-0012	38- PIO 05-0050	44- PIE-A 02-0022
3- PIE-A 02-0022	9- PI 09-0154	15- PI 09-0022	21- PIO 05-0031	27- PI 09-0001	33- PI 09-0121	39- PI 09-0051	
4- PIO 01-0028	10- PI 09-0155	16- PI 09-0019	22- PI 09-0042	28- PI 09-0004	34- PIE-A 02-0022	40- PIE-A 02-0022	
5- PI 07-0828	11- PI 09-0156	17- PI 09-0020	23- PI 09-0043	29- PI 09-0007	35- PIO 05-0044	41- PIO 06-0053	
6- PIEP 97-0001	12-PIE-A 02-0022	18- PI 09-0021	24- PI 09-0044	30- PI 09-0010	36- PI 09-0025	42- PI 09-0045	

Screening of the progenies with sugarcane SSR primers

* The arrows indicate the presence of the male specific markers in the hybrids.

Results

Erianthus hybrids	Female	Male	Brix % of Erianthus hybrids	Number of Stage I seedlings	Number of Stage II clones	Brix % in stage II	Number of Stage III clones
PI 09-0018	PIO 01-0022	PIE-A 02-0022	17.5	137	7	17 to 21	2
PI 09-0020	PIO 01-0022	PIE-A 02-0022	14	154	6	16 to 18	2
PI 09-0023	PIO 01-0022	PIE-A 02-0022	15.5	6	-	-	
PI 09-0044	PIO 05-0031	PIE-A 02-0021	15	3	1	17.6 to 18	1
PI 09-0004	PIO 05-0042	PIE-A 02-0022	12.5	6	-	-	
PI 09-0012	PIO 05-0042	PIE-A 02-0022	20	73	3	16 to 18	2
PI 09-0051	PIO 05-0050	PIE-A 02-0022	9.5	145	8	12 to 17	
PI 09-0046	PIO 06-0053	PIE-A 02-0022	11	59	1	15 to 17	
PI 09-0001	PIO 05-0042	PIE-A 02-0022	13	72	3	16 to 18	2
PI 09-0156	PIO 01-0006	PIE-A 02-0022	12.5	12	1	19 to 21	
		Total		667	30		9

Cultivars with commercial potential

S.No	Sugarcane cultivars	Stalk Length (m)	Stalk Thickness (cm)	Internode length (cm)	Stalk colour	Brix %	Remarks
1	PI 12-0877	3.38	2.62	14.24	GP	15, 14.8	Tall cane, medium thick cane
2	PI 12-0583	3.21	2.74	13.36	PD	16.2, 17	Tall, medium thick cane
3	PI 12-0533	2.87	2.78	12.16	YG	15, 15.4	Medium tillering, tall erect cane
4	PI 12-0703	3.82	2.34	15.54	YG	16.4,17.4	High tillering, thick cane
5	PI 12-0659	2.98	2.18	15.70	P	20, 20.8	Medium tillering, tall cane
6	PI 12-0886	2.34	3.10	12.10	YG	15.4,17	High tillering
7	PI 12-0815	3.10	2.72	11.70	YG	16, 17	High tillering, tall and thin cane
8	PI 12-0744	2.91	2.92	13.30	YG	15, 15.4	Medium thick, long internode
9	PI 12-0895	2.53	2.96	10.00	GY	16,16	High tillering, thick cane

Potential commercial cultivars

PI 12-0659



PI 12-0703



Conclusion

Initial studies indicate the possibility of creating commercial cultivars

The data indicated the high Brix combined with high tillering and high fibre traits transmitted from *Erianthus arundinaceus*.

Further the selected clones will be evaluated for preliminary yield trial, a replicated trial at different locations and will be subjected to disease screening.

The study would also be expanded to select multipurpose varieties with high biomass suited for bioenergy production.



Acknowledgements

The authors are grateful to the management of E.I.D. Parry for permission to publish the research findings.

Dr.N.Vijayan Nair and Dr A.Selvi of Sugarcane Breeding Institute, Coimbatore are thanked for the molecular analysis of intergeneric hybrids.


THANK YOU