New cane Varieties to Promote yield and recovery of Sugar cane in Sindh.

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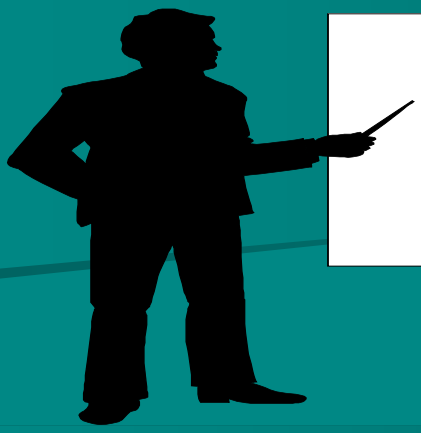


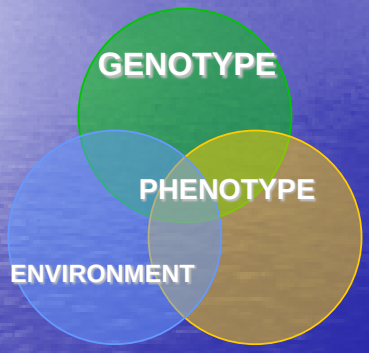
Sugar yield
Cane yield

Sugarcane

Family = *Gramineae*
Genera = *Saccharum*
Species = o*fficinarum* (nobel cane)
***sinense* (contain sugar)**
***barberi* (contain sugar)**
s*pontaneum* (little/ no sugar)
***robustum* (little / no sugar)**
***edule* (no inflorescences)**

commercial cane is the hybrid of more than three species. (Irvine 2004)

BIODIVERSITY



PLANT DIVERSITY OBTAINED FROM

DIFFERENT WILD SPECIES
MUTATION
BIOTECHNOLOGY

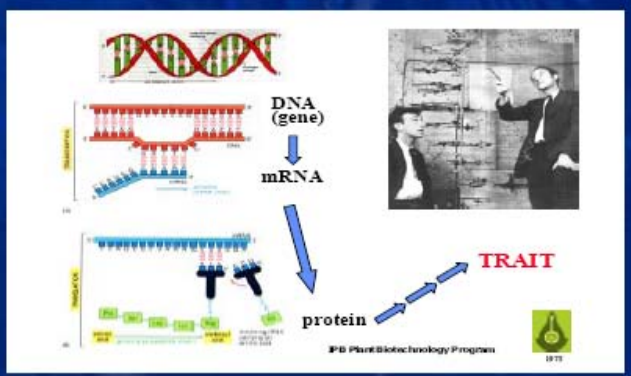
Gene(s) → Trait

Gregor Mendel (1860s)

idea of a gene

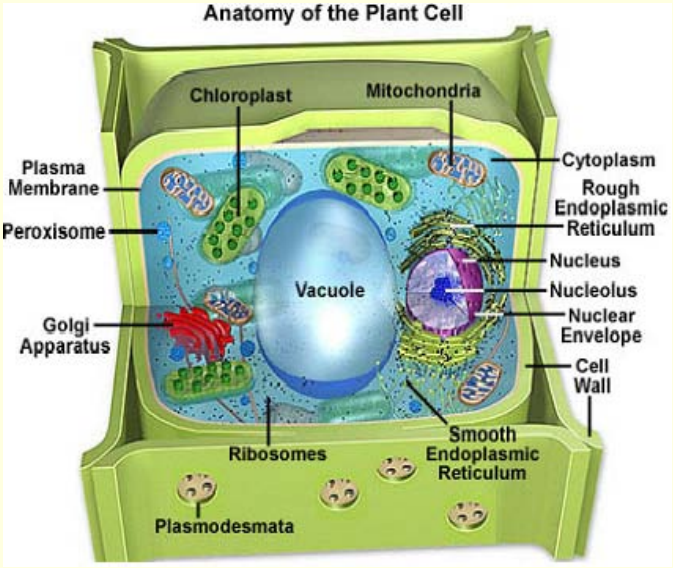
James Watson & Francis Crick (1960s)

identity of a gene (DNA)



Genetic information in plants

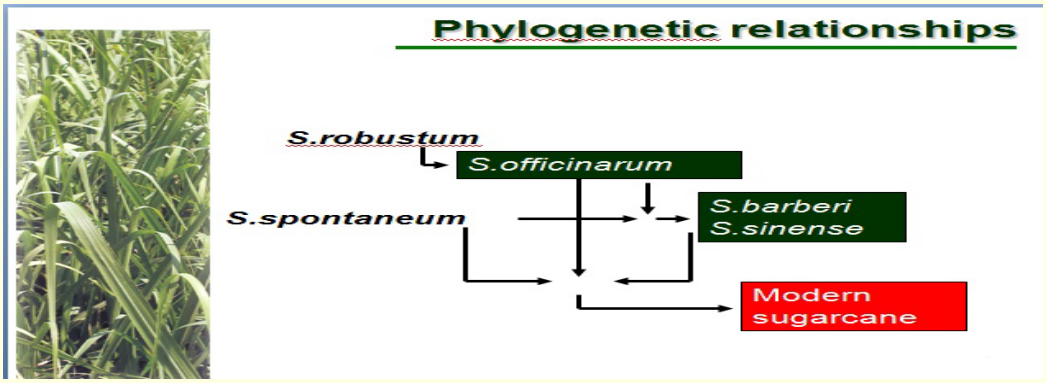
- **Nucleus**
- **Mitochondria**
- **Plastids**



Near about 125 different physiological reactions are involved in sucrose accumulation in sugarcane (Selvi et al., Crop Sci. 45:1750-1757, 2005)

Sugar cane members of genus *Saccharum*.

Species	Classification	Sugar content	Chromosome number
S. spontaneum	Wild species	Nil	2n= 40-128
S. robustum	Wild species	Nil	2n= 60-~200
S. officinarum	Noble canes	High	2n= 80
S. barberi	Ancient hybrid	Low	2n= 111-120
S. sinense	Ancient hybrid	Low	2n= 80-124
S. edule	Wild species	Compacted inflorescence eaten as a vegetable	2n= 60-80 with aneuploid forms



Sugarcane bio informatics

Genetic resources of Sugar in cane

- *Officinarum* (nobel cane)
- *robustum* (little / no sugar)

-ve correlation

Genetic resources of tolerance in cane

- *Spontaneum* (Source of tolerance) (Contain little or no sugar)

Modern sugarcane contain 80-85% officinarum blood and 8-10% spontaneum (Jannoo et al., Theor. Appl. Genet. 99:171-184. 1999)

Climate Extreme

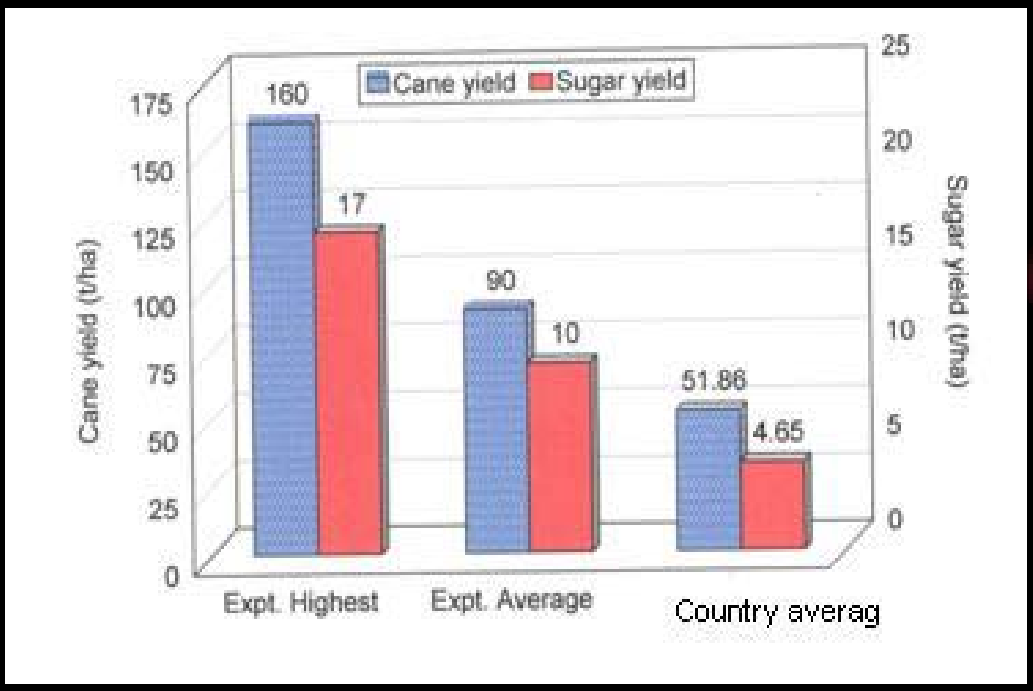
- Change in frequency and intensity of droughts
- Increase Frequency of heavy storms
- Flooding of lowland areas
- Increased extent of soil erosion
- Increased leaching of plant nutrients and fertiliser

Cane yield, sugar recovery and sugar yield in main sugarcane growing countries of the world

Country	Cane yield (t/ha)	Recovery (%)	Sugar yield (t/ha)
Australia	100.4	13.8	13.85
Egypt	110.8	11.5	12.74
Brazil	68.4	14.5	9.91
U.S.A.	80.2	11.7	9.38
Colombia	80.5	11.5	9.26
Mexico	79.5	11.6	9.22
India	66.9	9.9	6.62
Pakistan	50.3	9.2	4.63
World Avg.	64.4	10.6	6.82

Source: FAO Production Yearbook,

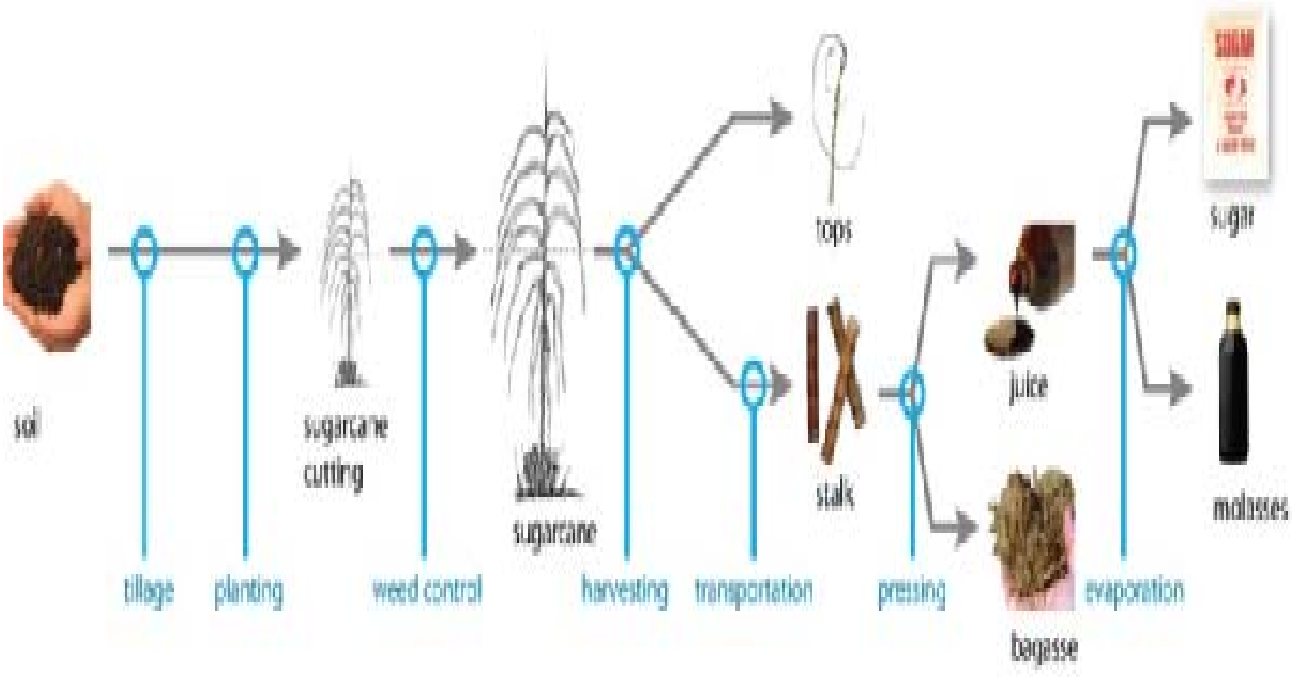
Cane & Sugar Yield Gap in Experimental and farmers field



FARMERS

INDUSTRY RESEARCH

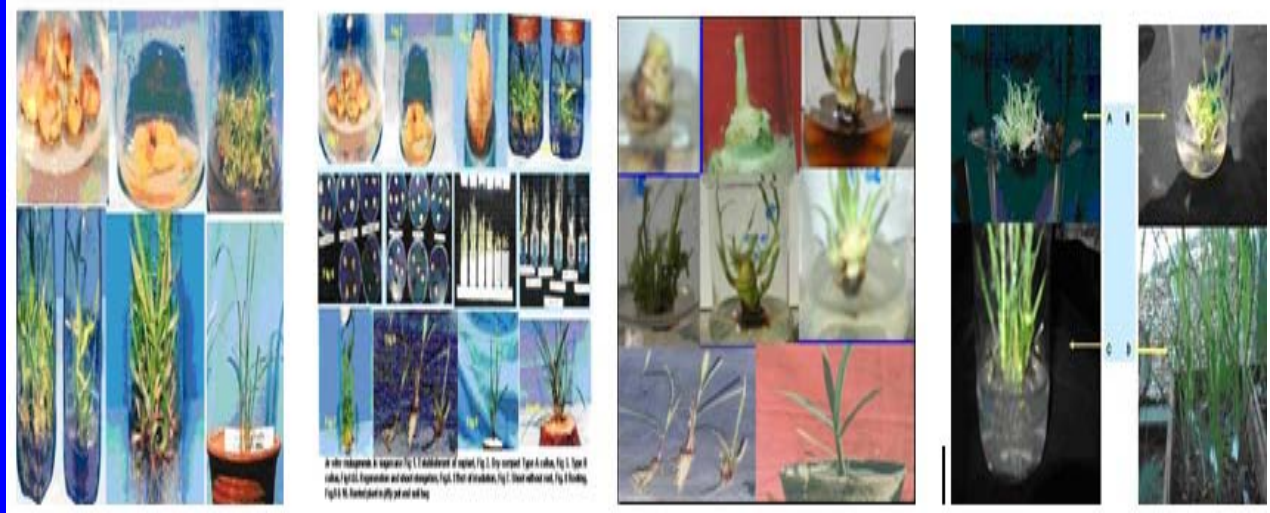
Existing Sugarcane Process



What NIA, Tando Jam is contributing in this respect

Sugarcane germination through fuzz obtained from Sri lanka

In vitro culture studies in sugarcane



Callus Culture *In-vitro* Mutagenesis Micropropagation Direct Regeneration


Parent


Somaclones

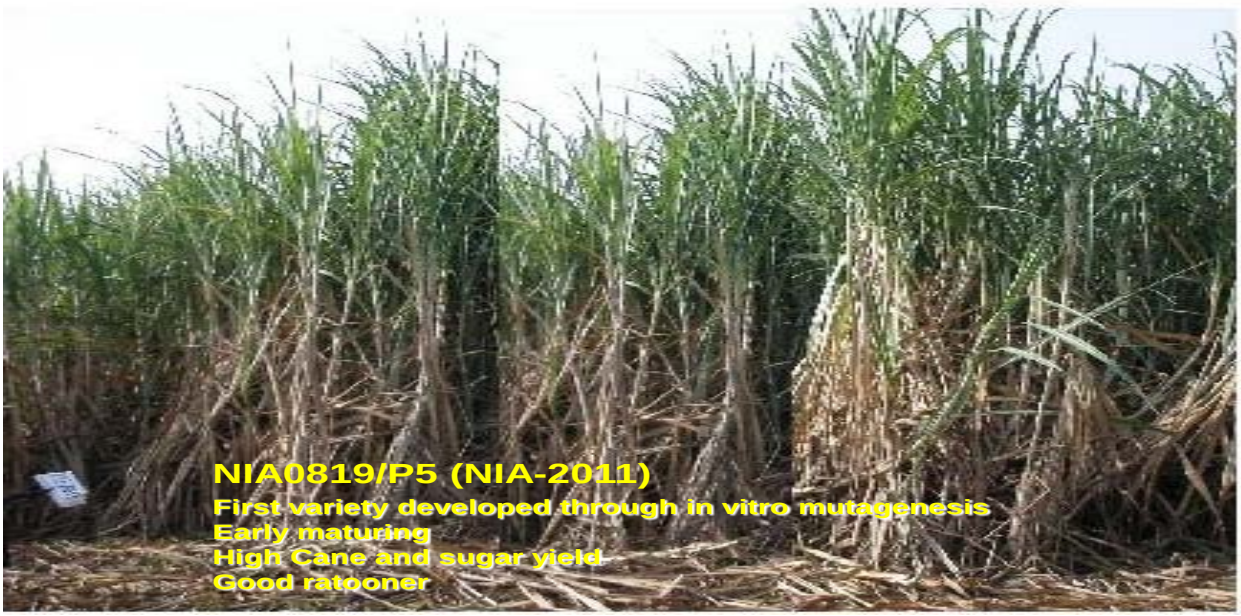

In vitro mutagenesis


Direct Regeneration


Somaclones
Parent (NIA-2004)


NIA-2004


NIA-2010
First variety developed through tissue culture
High cane and sugar yield
Resistant against borer


NIA0819/P5 (NIA-2011)
First variety developed through in vitro mutagenesis
Early maturing
High Cane and sugar yield
Good ratooner

SUGAR MILLS CO-ORDINATED TRIAL

Sugar Mills Coordinated trial (2010-2013)

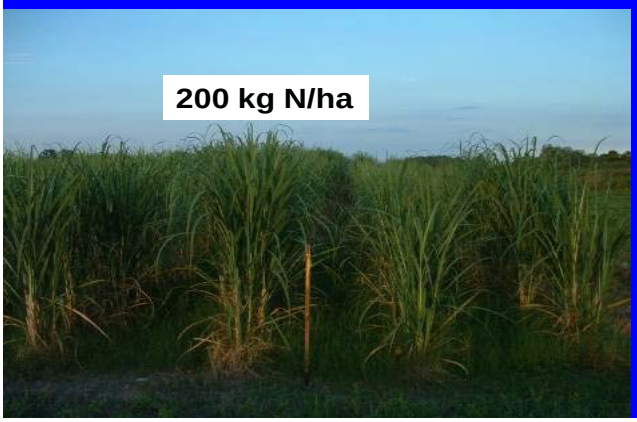
Clones / Locations	Stalk / stool (Nos)	Cane length (cm)	Cane girth (cm)	Weight/ stool (kg)	Cane yield (t/ha)	CCS %	CCS (t/ha)
NIA-2011 (NIA82-0819/P5)	**5.8ab**	**276.6 a**	**2.57 c**	**5.67 b**	**136.67 a**	**16.14 a**	**22.05a**
NIA-2004	5.0c	215.0 c	2.43 d	4.55 c	125.25 ab	15.56 b	19.49 a
CPF-237	6.4a	226.6bc	3.03 a	5.31 b	109.50 b	14.48 b	15.85 b
Thatta-10	4.8c	214.1 c	2.75 b	6.68 a	118.83 ab	13.67 c	16.24 b

PERIODICAL ANALYSIS OF 1st VARIETAL TRIAL 2013-2014.								
S: No.	VARIETY	SUGAR RECOVERY %						
		Oct	Nov	Dec	Jan	Feb	March	Average
1	SPF.234	8.56	8.76	9.76	10.49	11.23	11.29	10.25
2	HS.12	9.73	9.94	10.72	11.07	11.32	11.65	10.90
3	CPF.246	9.03	9.76	10.18	10.81	11.39	11.65	10.69
4	CPF.247	8.76	10.00	10.56	11.54	11.67	11.78	10.97
5	HSF.240	8.34	8.58	10.16	10.58	11.18	11.48	10.32
6	NIA.2004	8.86	8.96	10.28	10.71	11.33	11.42	**10.47**
7	NIA.2011	8.14	8.78	9.72	10.44	11.06	11.23	**10.15**
8	S.2009-HS.21	8.49	8.74	10.28	10.34	10.48	10.96	10.09
9	S.2009-HS.22	7.71	8.87	9.44	10.35	10.73	10.46	9.82
10	CPHS.24	7.92	9.47	10.48	10.93	11.12	11.30	10.48
11	NSG.59	8.58	8.75	10.25	10.85	10.61	11.53	10.34
12	HOSG.529	8.85	9.04	10.36	10.74	11.32	11.77	10.59
13	S.2003-US.114	8.52	8.65	10.07	10.56	10.94	11.23	10.22
14	S.2003-US.778	9.16	9.49	10.03	10.55	11.03	11.21	10.42

PERIODICAL ANALYSIS OF FINAL VARIETAL TRIAL (RATOON) 2013-2014.								
S: No.	Variety	Sugar recover %						
		Oct	Nov	Dec	Jan	Feb	March	Average
1	SPF.234	7.43	7.78	9.45	10.39	10.89	11.84	10.00
2	HS.12	8.05	8.40	10.18	11.02	11.57	11.90	10.51
3	CPF.246	9.07	9.36	10.05	11.31	11.72	12.14	10.86
4	CPF.247	8.36	8.60	9.99	10.92	11.48	12.08	10.55
5	NIA.2004	7.62	8.66	10.17	10.35	10.77	11.24	**10.10**
6	NIA.2010	7.76	7.86	8.96	10.77	11.05	11.63	**10.00**
7	NIA.2011	8.20	8.39	8.69	9.95	11.08	11.55	**9.92**
8	HOTH.300	7.58	7.72	8.80	10.32	11.07	11.63	9.86
9	CPHS.24	8.21	8.35	9.23	10.81	11.09	11.61	10.17
10	NSG.59	7.42	7.71	10.14	10.95	11.23	11.82	10.24
11	HOTH.2109	8.23	8.86	10.05	10.51	10.69	11.28	10.19
12	HOTH.311	9.26	9.58	9.99	10.48	11.01	11.86	10.58
13	HOTH.326	8.83	8.99	9.70	10.43	10.71	11.57	10.27
14	HOTH.318	7.37	7.67	9.16	10.75	11.51	11.80	10.08

Sugar analysis Reported by Mirpurkhas Sugar Mills 2013 (Plant Crop)

Variety	No. samples	Brix %	Pol %	Purity %	Recovery %
NIA-2004	5	19.79	17.07	84.34	9.37
NIA-2010	4	20.15	16.38	81.31	8.60
Thatta-10	3	18.66	16.82	90.29	9.67
NIA-2011	6	20.64	17.75	86.03	9.82
SPF-234	3	18.49	16.38	88.57	9.28



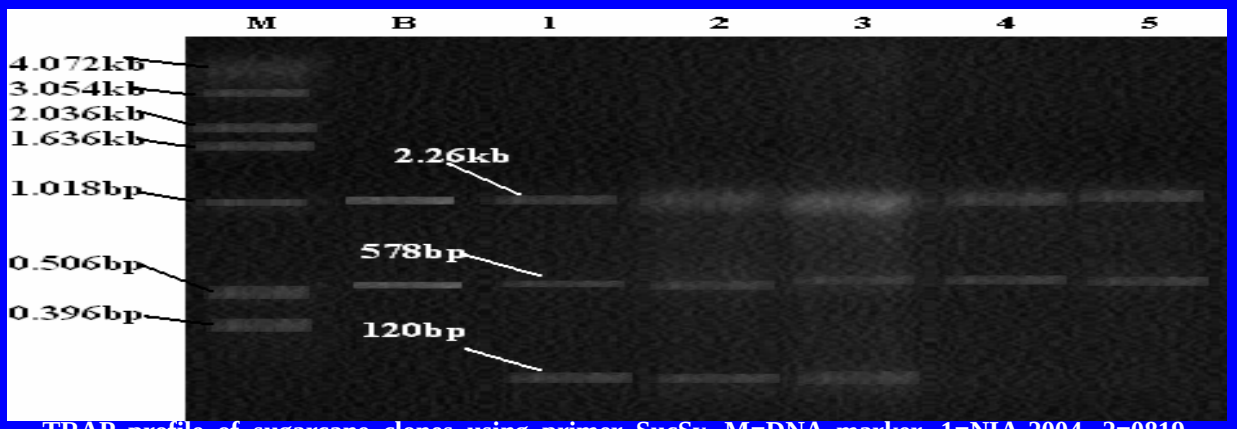
Impact of NIA-2011

Averages of 21 different locations

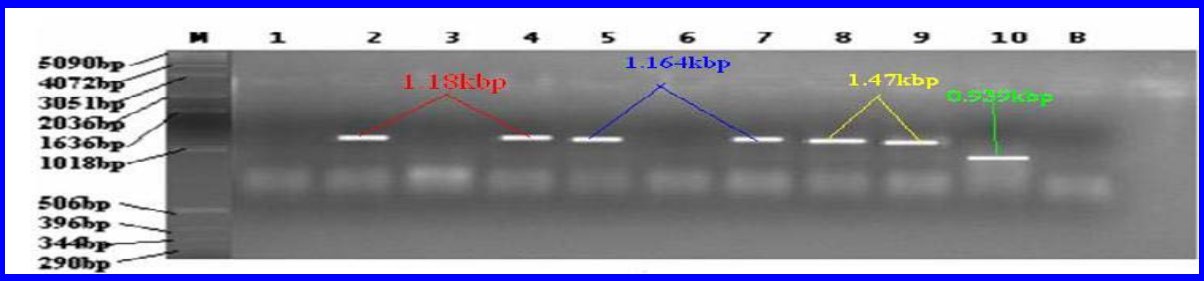
Clones	Cane yield (t/ha)	Sugar yield (t/ha)	Enhanced cane yield t/ha	Enhanced sugar yield t/ha
NIA-2011	123.53	16.60		
Check yield (Thatta-10)	99.96	12.54	23.57 (238 mounds/ acre)	4.06 (1644 kg/acre)

NIA-2011 has the potential to raise the cane yield by 238 mounds/acre
NIA-2011 has the potential to raise the sugar yield by 1644 kg/acre

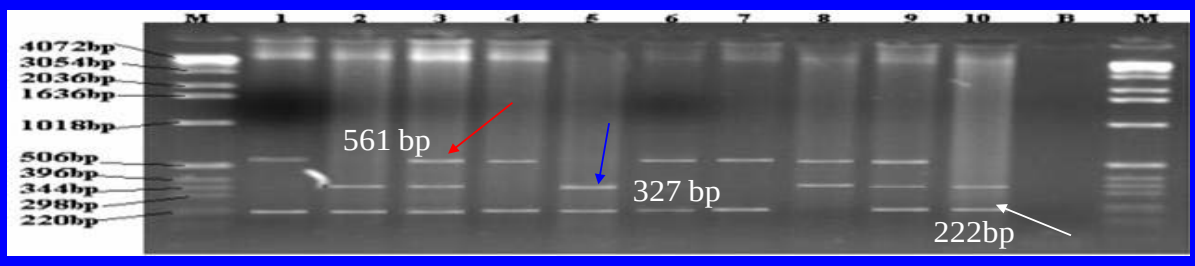
Profile of sucrose producing gene Sucrose synthetase



TRAP profile of sugarcane clones using primer SucSy, M=DNA marker, 1=NIA-2004, 2=0819, 3=L116, 4= NIA-98, 5=LRK-2001



STS profile of sugarcane genotype using DREB sequence; M=DNA marker, 1= AEC82-1026, 2= GT-11, 3= AEC92-105, 4= AEC71-2011, 5= Thatta-10, 6= AEC82-223, 7= NIA-2011, 8= NIA-2004, 9= AEC86-328, 10= L116, B= Blank



TRAP profile of sugarcane genotype using surose synthase; M=DNA marker, 1= AEC82-1026, 2= GT-11, 3= AEC92-105, 4= AEC71-2011, 5= Thatta-10, 6= AEC82-223, 7= NIA-2011, 8= NIA-2004, 9= AEC86-328, 10= L116, B= Blank

Up coming clones	Status
NIA-2011	Registration with FS & RD completed
NIA-2012	One year data is completed with FS & RD Sugar Mills coordinated Trial
NIA-2013	Sugar Mills coordinated trial
NIA-2014	Will be advanced to zonal trial next year
15 promising clones are in different stages of evaluation	In different stages of evaluation

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sugarcane

Google scholar

Citation indices

	All	Since 2009
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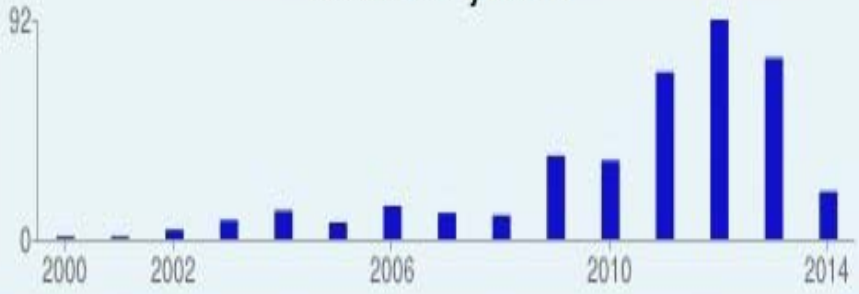
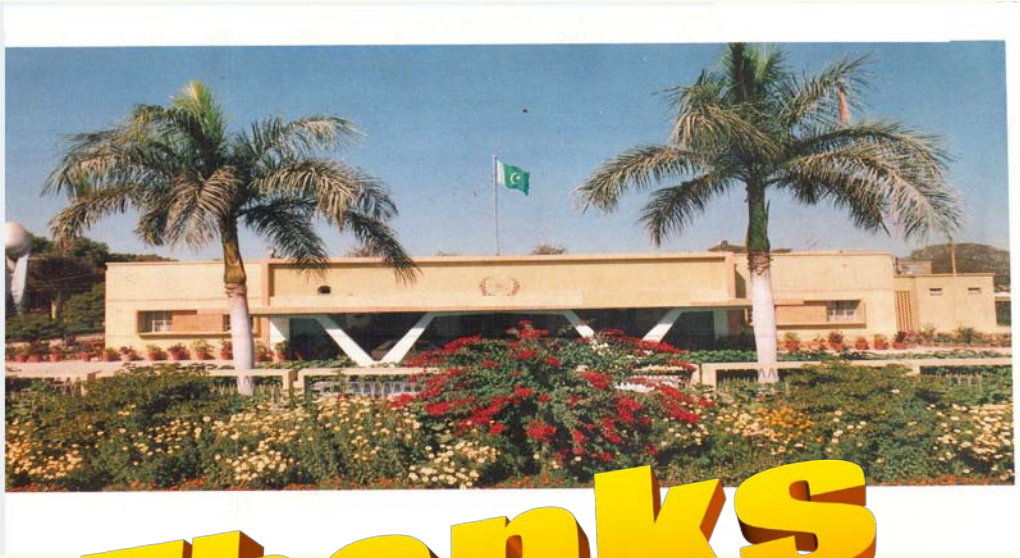
h-index	12	10
i10-index	15	11

Citations to my articles





Thanks