

SUGAR CANE R & D PRESENT STATUS & FUTURE PROSPECTS

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By:

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BRIEF HISTORY

- | | |
|--|------|
| ■ Establishment of Sugarcane Research Station, Lyallpur | 1934 |
| ■ Permanent feature of Agri. Department under Punjab Agriculture College, Lyallpur | 1949 |
| ■ Separation of AARI from University and attachment of Sugarcane Section | 1962 |
| ■ Up-gradation of Sugarcane Section to Sugarcane Research Institute, Faisalabad | 1978 |

OBJECTIVES

- ✓ **Cane Variety development for:**
 - High cane yield
 - High sugar recovery
 - Good ratoon
- ✓ **Cane Production Technology**
- ✓ **Sugarcane Technology**
- ✓ **Sugarcane Diseases and Pests Control**

ORGANOGRAM

SECRETARY AGRICULTURE

Director General Agriculture (Research)

Director

SRI, Faisalabad

Sugarcane Specialist = 1
Asstt. Agronomists = 3
Asstt. Res. Officers = 7

Sugarcane Agronomist = 1
Asstt. Botanists = 2
Asstt. Res. Officers = 1

SRS, Khanpur

Sugarcane Agronomist = 1
Asstt. Res. Officers = 2

Sugarcane Virologist = 1
Asstt. Plant Pathologist = 1
Asstt. Entomologist = 1

SRSS, Bahawalpur

Asstt. Agronomist = 1

SBRSS, Murree

Asstt. Res. Officer = 1

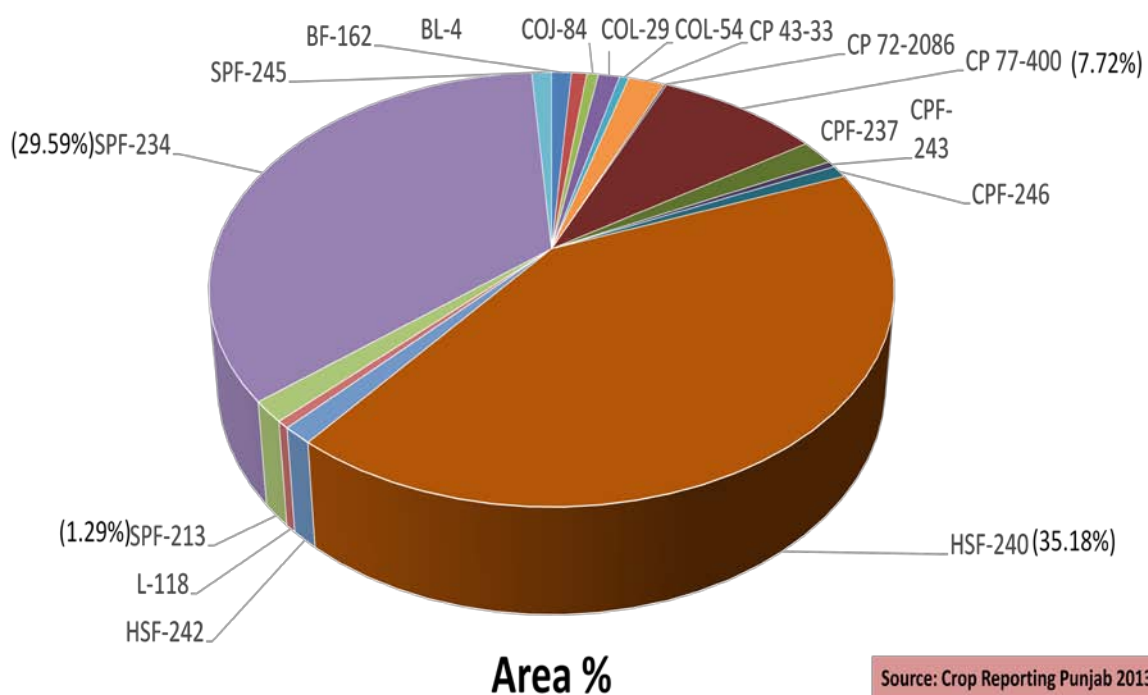
Sugarcane Technologist = 1
Asstt. Agri. Chemist = 2
Asstt. Res. Officers = 1



ACHIEVEMENTS

VARIETAL COMPOSITION OF SRI VARIETIES IN PUNJAB

2013-14



Source: Crop Reporting Punjab 2013

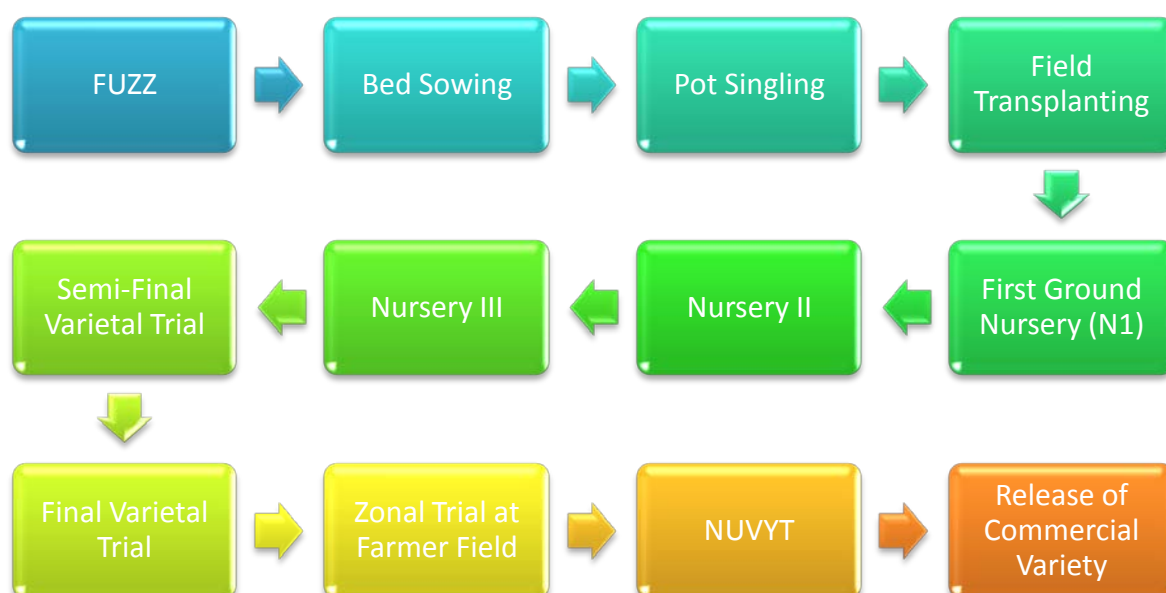
SUGARCANE IN PAKISTAN

2012-13 vs. 2013-14

Provinces	Sugarcane area (000 ha)			Sugarcane production (M.T.)			Sugarcane yield (t ha ⁻¹)			Sugar recovery (%)
	2012-13	2013-14	Change %	2012-13	2013-14	Change %	2012-13	2013-14	Change %	
Punjab	767.7	723.6	-5.7	42.98	40.84	-4.97	56.0	56.4	0.8	9.92
Sindh	253.7	297.6	17.30	15.96	17.37	8.80	62.9	58.4	-7.2	10.49
KPK	106.7	107.7	0.9	4.77	4.82	1.1	44.7	44.8	0.2	9.23
Baluchistan	0.7	0.7	0.7	0.31	0.32	2.2	45.0	46.0	2.2	--
Pakistan	1128.8	1129.6	0.1	63.75	63.07	-1.1	56.5	55.8	-1.1	9.88

Source: Ministry of Food and Agriculture & PSMA 2013

PROCESS



APPROVED VARIETIES OF SRI, FSD

Sr. #	Varieties	Year of Release	Av. Yield (t ha ⁻¹)	Sugar Recovery (%)	Sugar Yield (t ha ⁻¹)
1947-1977 (30 years)					
1.	CoL-29	1954	70	10.10	7.07
2.	CoL-44	1954	75	8.93	6.69
3.	CoL-54	1963	75	9.63	7.22
4.	BL-19	1966	85	9.49	8.00
5.	BL-4	1968	85	10.34	8.79
6.	L-116	1973	75	10.81	8.11
7.	L-118	1975	83	8.23	6.83

Sr. #	Varieties	Year of Release	Av. Yield (t ha ⁻¹)	Sugar Recovery (%)	Sugar Yield (t ha ⁻¹)
1978-1998 (20 years)					
8.	Triton	1983	85	10.10	8.58
9.	BF-162	1990	90	10.35	9.31
10.	CP43-33	1996	80	11.69	9.35
11.	CP72-2086	1996	85	12.35	10.49
12.	CP77-400	1996	90	11.90	10.72

Sr. #	Varieties	Year of Release	Av. Yield (t ha ⁻¹)	Sugar Recovery (%)	Sugar Yield (t ha ⁻¹)
2000-2013 (13 years)					
13.	CoJ-84	2000	90	9.80	8.82
14.	SPF-213	2000	90	10.50	9.45
15.	CPF-237	2000	95	12.50	11.87
16.	HSF-240	2002	95	11.70	11.11
17.	SPF-234	2002	100	11.60	11.60
18.	SPF-245	2004	100	11.00	11.00
19.	HSF-242	2006	102	12.50	12.75
20.	CPF-243	2006	102	12.55	12.80
21.	CPF-246	2011	105	12.00	12.60
22.	CPF-247	2011	105	12.25	12.86
23.	CPF-248	2013	113	12.71	14.32

PIPELINE VARIETIES OF SRI, FSD

Sr. #	Name of clones	Av. Yield (t ha ⁻¹)	Yield potential (t ha ⁻¹)	Sugar Recovery (%)	Remarks
1.	S2003-US 127	106	125	12.60	Early
2.	S2003-US 633	105	130	13.50	Early
3.	S2003-US 704	107	135	12.80	Medium
4.	S2003-US 778	105	130	12.45	Medium
5.	S2005-US 54	107	135	12.60	Early
6.	S2006-US 272	107	135	12.60	Early
7.	S2006-US 658	106	125	12.40	Medium

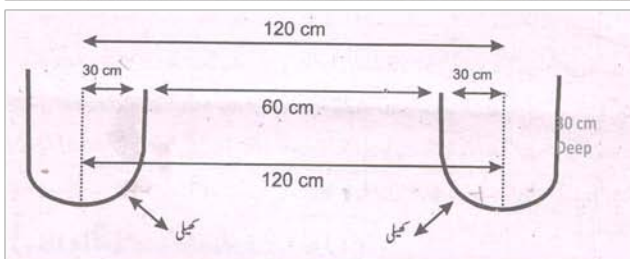
COMPARISON OF CANE YIELD AND SUGAR RECOVERIES OF PAK PUNJAB & INDIAN PUNJAB

Year	Pak Punjab		Indian Punjab	
	Cane Yield (t ha ⁻¹)	Sugar Recovery (%)	Cane Yield (t ha ⁻¹)	Sugar Recovery (%)
1951-1960	31.80	8.09	32.91	9.30
1961-1970	35.15	8.17	34.86	8.42
1971-1980	36.13	8.37	50.02	8.88
1981-1990	36.20	8.27	60.65	9.85
1991-1995	39.20	8.23	58.80	9.25
1995-2000	42.80	7.92	61.60	8.84
2001-2005	47.30	8.60	60.70	9.67
2006-2010	48.50	8.80	58.60	9.33
2011-2012	61.20	9.41	59.80	8.70

SUCCESS STORY OF VARIETY EVOLUTION AT SRI

- International collaboration:
 - ✓ Varieties of CP origin like CPF-246, CPF-247, CPF-248 are very successful in Pakistan, fuzzi imported from U.S.A.
 - ✓ Varieties like CP77-400, CP72-2086 & CP43-33 were directly imported from U. S. A.
 - ✓ Varieties of SP origin like SPF-213 is successful in all Punjab and SPF-234, a good performers in Southern Punjab, fuzzi imported from Brazil
- Local collaboration:
 - ✓ HSF-240 is a joint collaborative effort of Habib Sugar Mills and SRI Faisalabad

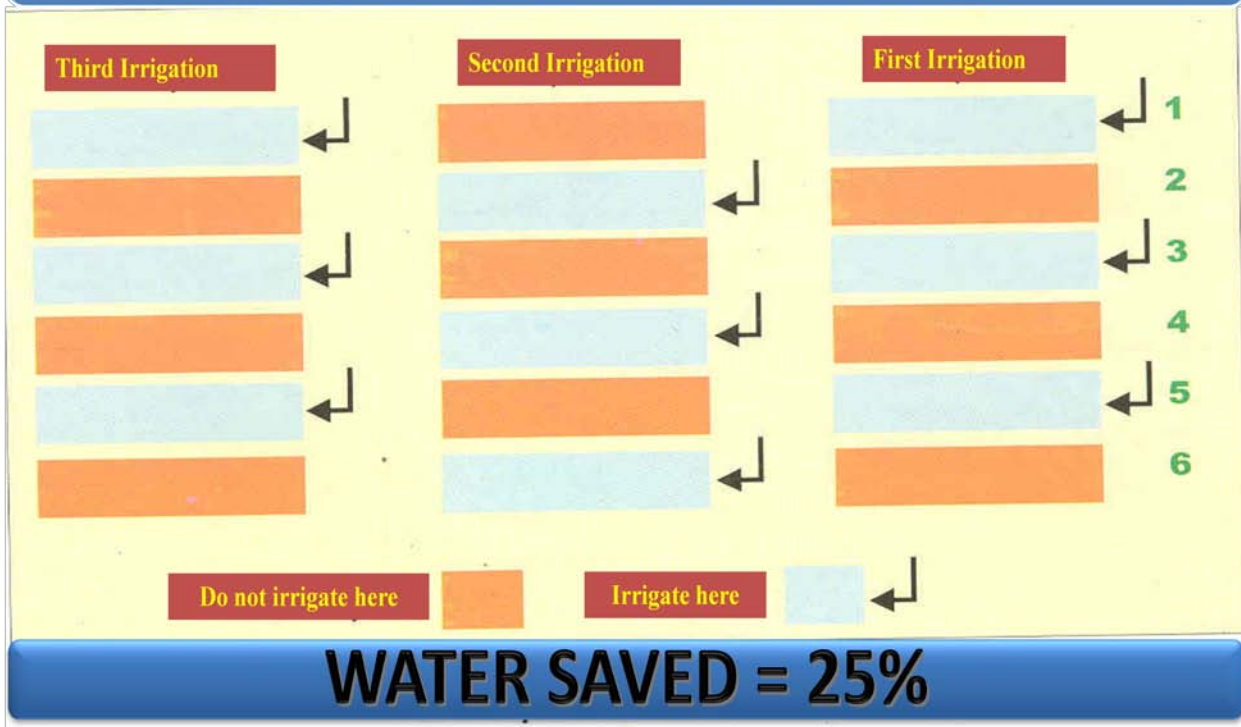
DEEP TRENCH PLANTING TECHNIQUE



Water
saving
~47%

Yield
increase
~22%

ALTERNATE SKIP IRRIGATION



CHALLENGES FOR SUGARCANE RESEARCH & DEVELOPMENT

Fuzz
Production

Low Cane
Yield

Low Sugar
Recovery

CAUSES OF LOW CANE YIELD

- Improper land preparation
- Lack of seed propagation facilities
- Use of low seed rate
- Planting time
- Planting method
- Inadequate and imbalanced fertilizer use
- Costly inputs
- Scarcity of irrigation water
- Weed infestation
- Poor plant protection measures
- Sowing of unapproved varieties
- Poor management of ratoon crop

CAUSES OF LOW SUGAR RECOVERY

- Sowing of low sugar varieties
- Payment on weight basis
- Supply of staled and un-cleaned cane
- Late application of fertilizer
- Application of water before harvesting
- Un-scheduled supply of cane to the mills
- Supply of cane to mills is not according to the maturity schedule
- Poor development work by the mills
- Appointment of un-qualified staff
- Late planting
- Supply of diseased and insect infected cane
- Inefficient processing

HOW SRI ADDRESSING?

- **Fuzz Production**

- ✓ Collaboration with Sri-Lanka for cane fuzz production & import
- ✓ Import of fuzz from Mauritius, Philippines, U.S.A., Barbados & Bangladesh
- ✓ Exchange of cane germplasm with Sri-Lanka, Mauritius & Philippines

- **Low Cane Yield**

- ✓ Approval of high cane yielding varieties
- ✓ Improved production technology

- **Low Sugar Recovery**

- ✓ Consolidated variety selection program
- ✓ High sugar recovery germplasm introduction from foreign countries

GROWING SEEDLINGS FROM CANE FUZZ – A BASE FOR NEW VARIETY EVOLUTION



INTERNATIONAL COLLABORATION

- Sugarcane Field Station, Canal Point, **USA**
- Sugarcane Research Institute, **Sri Lanka**
- Philippine Sugar Research Institute, **Philippine**
- Mauritius Sugar Industry Research Institute, **Mauritius**
- South African Sugarcane Research Institute, **South Africa**
- Bangladesh Sugarcane Research Institute (BSRI), **Bangladesh**
- West Indies Central Sugar Cane Breeding Station, **Barbados**

PARB PROJECTS AT SRI

Title	Estimated cost (Rs. Millions)	Status
Sugarcane plant improvement through traditional and modern breeding technologies	27.836	On-going
Development of transgenic sugarcane (<i>Saccharum officinarum</i> L.) against major abiotic stresses	19.587	On-going
Genetic Improvement of Sugarcane for herbicide and borer resistance	22.350	On-going

OVERALL IMPACT IN PUNJAB

Comparison	1999-00	2012-13	% increase
Area (000 ha)	672.10	767.67	12.45
Production (million tones)	25.00	42.98	41.83
Yield (tones/ha)	37.20	56.40	34.04
Recovery (%)	7.82	9.92	21.17

Source: PSMA Report 2013

AREA UNDER SRI VARIETIES

Punjab = 99%

Sindh = 80%

KPK = 95%

SUGARCANE PRODUCERS IN ASIA

#	Country	Area (000 ha)	Production (000 t)	Yield (t ha ⁻¹)	Crop Duration (Months)	Stripped Cane Yield/Unit time
1	Philippine	433	30000	69.24	18	69.24
2	India	5090	347870	68.34	12-18	68.34
3	Sri-Lanka	13	800	63.49	18	63.49
4	Indonesia	458	26342	57.68	18	57.68
5	Pakistan	1046	58038	55.49	10-15	79.91
6	Lao DPR	21	1056	51.52	18	51.52
7	Nepal	65	2930	45.45	18	45.45
8	Bangladesh	118	4850	41.10	18	41.10
9	Cambodia	17	365	21.47	18	21.47
	Ranking	2	2	5	-	1

Source: Ministry of Food and Agriculture

HOW TO ADDRESS?

- Provision of resources for efficient R & D
- Strengthening of infrastructure for effective work
- Bilateral collaboration with other countries for import of fuzzi/cane setts and exchange of germplasm
- Varietal exchange program with other sugarcane research institutes within Pakistan
- Foreign trainings of research scientists, awareness seminars and workshops

FUTURE STRATEGIES

- Continuity of fuzzi production from Sri-Lanka of desired characteristics
- Varietal exchange program with U.S.A., Brazil, Mauritius, Australia
- Import of elite germplasm from U.S.A., Brazil, Australia, Thailand, etc.
- Evaluation of site specific varieties
- Development of site specific production technology
- Establishment of quarantine station at Pail, Murree
- Establishment of Sugarcane Breeding Institute in Coastal area
- Establishment of Cane Seed Production Farm at Chak Jhumra
- Sugarcane maximization program at mill level



SUGARCANE MAXIMIZATION

INCREASING CANE YIELD FOR FARMERS

- Use of biotic & abiotic stress tolerant approved varieties through Biotechnology
- Use of organic fertilizer sources to reduce cost of production
- Use of water conservation technologies
- Use of farm machinery to reduce labor cost to enhance precision & efficiency
- Availability of subsidized farm implements, solar powered tube wells, bio-gas plants, and other inputs

REDUCED COSTS OF PRODUCTION

- **IRRIGATION**
(Improve WUE)



- **FERTILIZERS**
(Improve FUE)



- **HARVESTING**
(Reduce Losses)



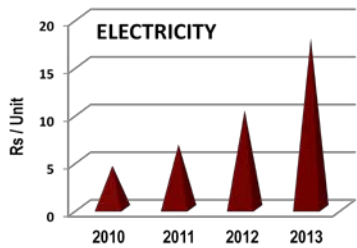
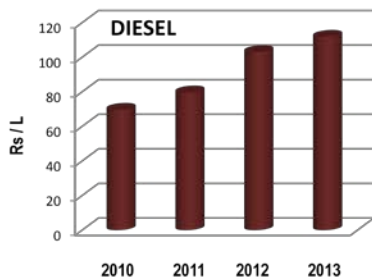
Water - a scarce commodity

Costly pumping of water due to rising cost of diesel & load-shedding

NEED FOR DROUGHT TOLERANT VARIETIES

SOLAR ENERGY—RENEWABLE ENERGY

RISING COSTS OF DIESEL AND ELECTRICITY

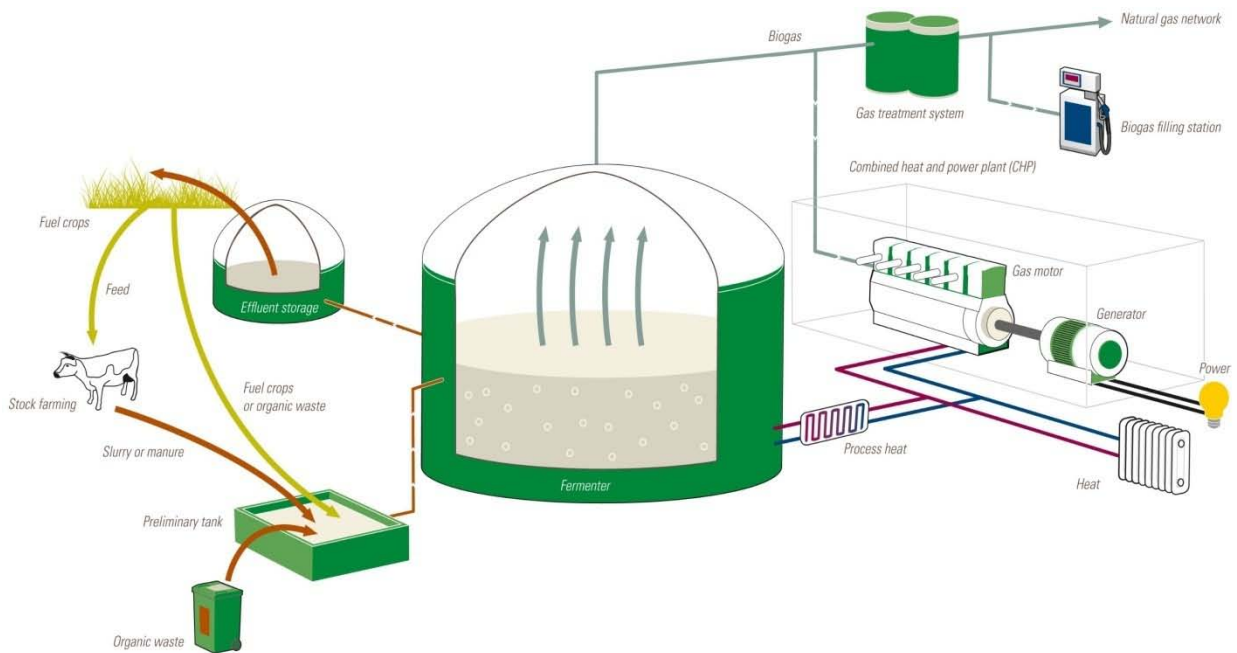


SOLAR POWERED TUBEWELL

60m³/h



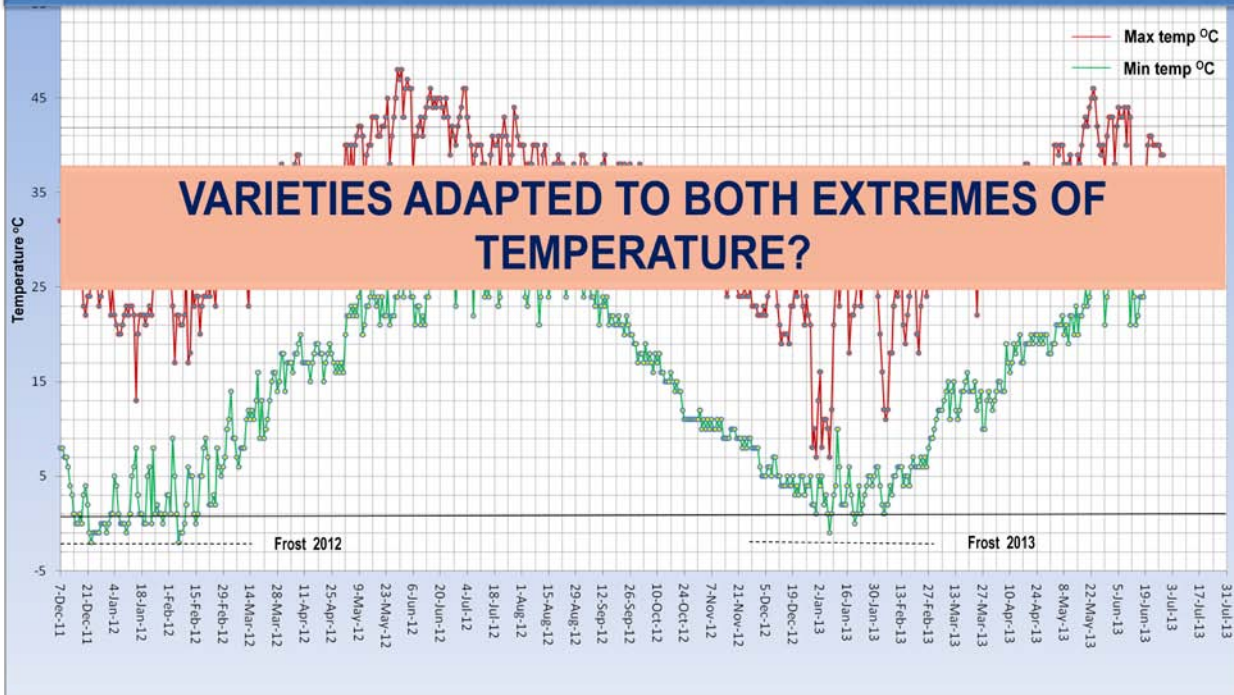
BIOGAS - RENEWABLE ENERGY



SALT TOLERANT CANE VARIETIES



MINIMUM AND MAXIMUM TEMPERATURE DURING 2011 - 2013



**Control measures are not always available
or accessible**

**Pesticides are costly and their use pose
environmental threat and human health
hazards**

VARIETIES RESISTANT TO PESTS AND DISEASES

BIOLOGICAL CONTROL

- ✓ Safe and efficient
- ✓ Long term control
- ✓ Environment friendly
- ✓ Cost effective

Trichogramma for control of sugarcane borers

Borer



Chrysoperla for control of whiteflies

LODGING---SERIOUS DISASTER

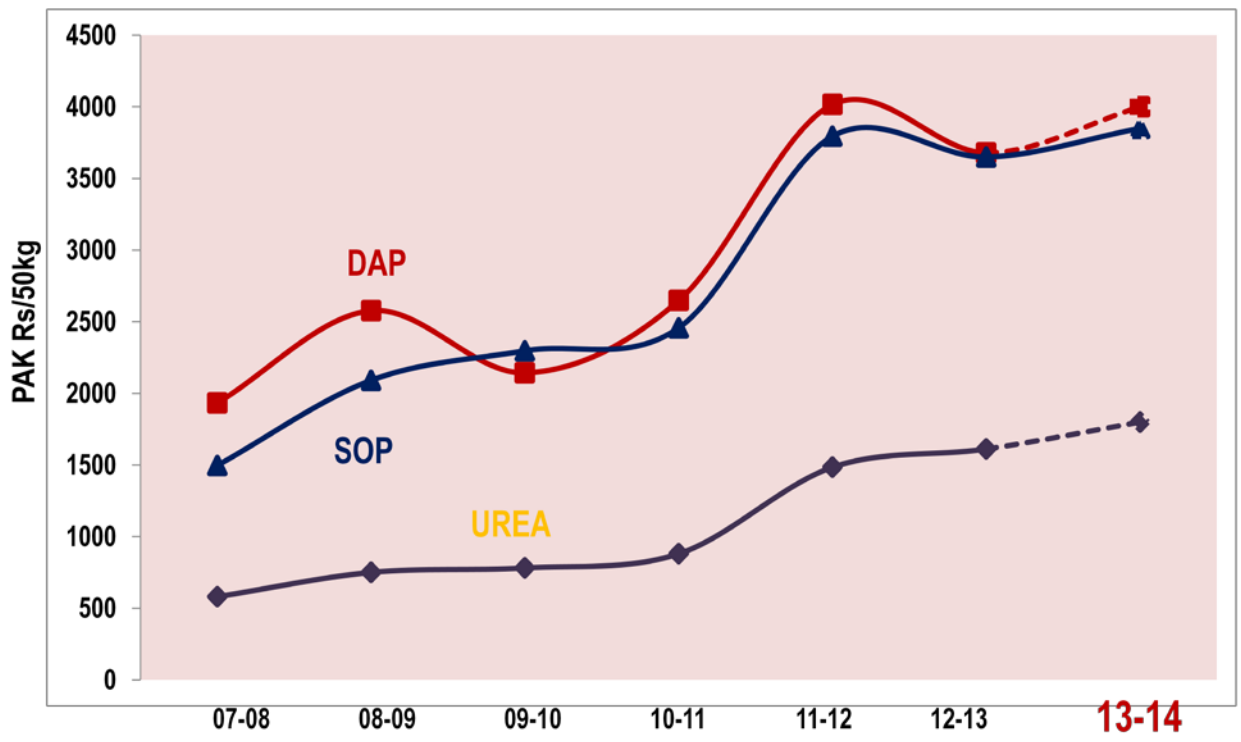


Up to 30% sugar yield loss due to lodging



ERECT CANES RESISTANT TO LODGING

RISING COSTS OF FERTILIZERS



FERTILIZER EQUIVALENCE & COSTS (COMPOST v/s MINERAL FERTILIZERS)

ORGANIC

**16 bags Compost/acre
50kg UREA/acre
25kg SOP/acre**

Rs. 13,000

INORGANIC

**100kg DAP/acre
100kg SOP/acre
150kg UREA/acre**

Rs. 26,000

v/s

- Economy per acre of Rs. 13,000
- Provides equivalent NPK as mineral fertilizer sources
- Also contains secondary and micronutrients (Bonus)
- Improve SOM status and long term soil fertility (Bonus)

MECHANIZATION OF SUGARCANE HARVEST

Can harvest up to 10 tons ha⁻¹

Adapted to 4 ft and will clean cane from trash and tops

Speed up harvesting

Reduce time between cut and crush

Reduce losses in sugar recovery



INCREASING SUGAR RECOVERY FOR MILLERS

- Varietal Development Program at mill level
- Agro-meteorology studies for site specific variety development
- Establishment of model seed farm at mill level
- Production of organic fertilizer from filter cake
- Strengthening of quality control laboratory

SOP FOR VARIETAL DEVELOPMENT PROGRAM

- ✓ Appointment of Agri. Graduate in each Sugar Mill for development work
- ✓ Supply of approved cane varieties from Chak Jhumra Model Seed Farm to sugar Mills for adaptability & site specific studies
- ✓ Supply of recommended cane varieties to farmers by mills
- ✓ Subsidized supply of inputs including fertilizer, pesticides, etc.
- ✓ Seed and fertilizer loaning to farmers
- ✓ Quality based payment system implementation

BIO-COMPOSTING

Windrows Composting



VALORIZATION OF MILL BY-PRODUCTS AND ANIMAL WASTES (Pressmud, Ash, Molasses, Manure)

VALORIZATION OF SUGARCANE BIOMASS

Contribution of Sugarcane

- ✓ **Enhanced biomass production**
- ✓ **Co-generation**



HIGH FIBER CANE

MEDIUM TERM OBJECTIVES (5 YEARS)

Target: Av. Cane Yield: 90 t ha⁻¹ Av. Sugar Recovery: 11.00 %

- Approval of 3 to 5 cane varieties from existing germplasm that are superior to varieties in vogue
- Establishment/Strengthening of infrastructure for Sugarcane Research and Development in Punjab
- Aggressive efforts in extension work directly with farmers and through sugar mills to attain Yield and Recovery objectives
- Extra emphasis on education with respect to water use efficiency

Target: Av. Cane Yield: 90 t ha⁻¹ Av. Sugar Recovery: 11.00 %

- Site-specific studies in different agro-ecological zones for variety development and productivity enhancement at mill level
- Extensive efforts for development of seed farms for newly approved varieties
- Valorization of sugar mill by-products for benefit of sugarcane farmers
- Strengthening of international linkages and upgrading subject expertise in Punjab

LONG TERM OBJECTIVES (10 YEAR)

Target: Av. Cane Yield: 110 t ha⁻¹

Av. Sugar Recovery: 13 %

- Significantly expand and strengthen Sugarcane breeding and selection program
- Approval of site-specific varieties and development of production technology for different districts of Punjab
- Production of true seed of desired characteristics in Pakistan
- High fiber variety evolution for co-generation

Target: Av. Cane Yield: 110 t ha⁻¹

Av. Sugar Recovery: 13 %

- Capacity building of scientists
- Introduction of Genetically Modified (GMO) sugarcane varieties tolerant against abiotic stresses like frost, drought, salinity and biotic stresses like disease and insect pests
- Micro-management practices to enhance productivity
- Farm mechanization for sustainable sugarcane production



**THANK YOU
FOR YOUR
ATTENTION**

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