ROLE OF SUGARCANE RESEARCH INSTITUTE FAISALABAD IN ADDRESSING FUTURE THREATS

(Psst 48th. Convention 8-9 September 2014)

By:

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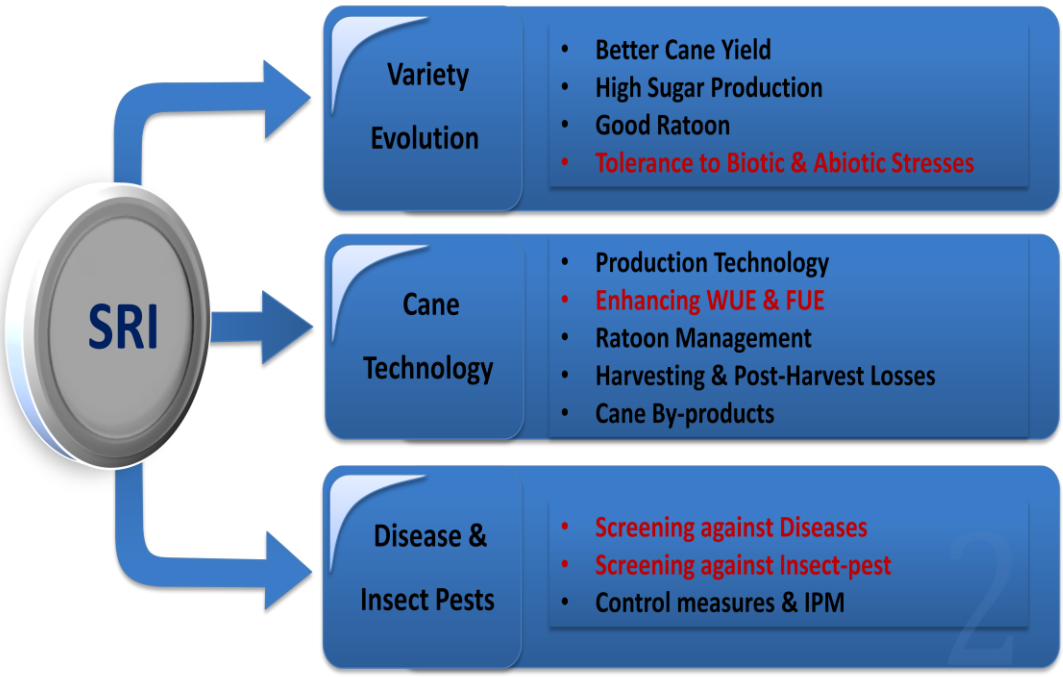
OBJECTIVES


SRI
Variety Evolution
Better Cane Yield
High Sugar Production
Good Ratoon
Tolerance to Biotic & Abiotic Stresses
Cane Technology
Production Technology
Enhancing WUE & FUE
Ratoon Management
Harvesting & Post-Harvest Losses
Cane By-products
Disease & Insect Pests
Screening against Diseases
Screening against Insect-pest
Control measures & IPM

CURRENT STATUS OF SRI

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 National Food Security & Research & PSMA 2013

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Source: Ministry of National Food Security & Research & PSMA 2013

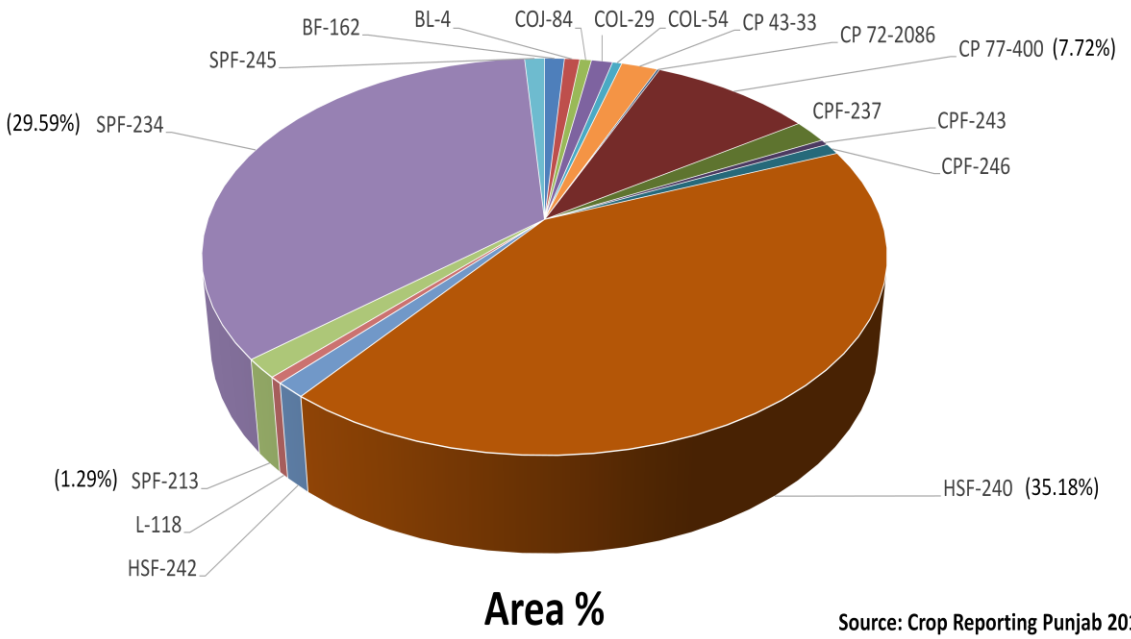
AREA UNDER SRI VARIETIES

Punjab = 99%

Sindh = 60%

KPK = 95%

VARIETAL COMPOSITION OF SRI VARIETIES IN PUNJAB 2013-14



Source: Crop Reporting Punjab 2013

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 National Food Security & Research 2013

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, fuzz 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, fuzz imported from **Brazil**
- ✓ Several advance lines of SRI, Faisalabad belong to germplasm imported from **U.S.A. and Australia**

National collaboration:

- ✓ **HSF-240** and **HSF-242** are joint collaborative effort of **Habib Sugar Mills** and **SRI Faisalabad**

PROMISING VARIETIES OF SRI, FSD

Sr. #	Varieties	Year of Release	Av. Yield (t ha^{-1})	Sugar Recovery (%)	Sugar Yield (t ha^{-1})
1.	SPF-213	2000	90	10.50	9.45
2.	HSF-240	2002	95	11.70	11.11
3.	SPF-234	2002	100	11.60	11.60
4.	CPF-246	2011	105	12.00	12.60
5.	CPF-247	2011	105	12.25	12.86
6.	CPF-248	2013	113	12.71	14.32

OVERALL IMPACT IN PUNJAB

Comparison	1999-00	2013-14	% increase
Area (000 ha)	672.10	756.75	**12.59**
Production (million tones)	25.00	43.70	**74.80**
Yield (tones/ha)	37.20	62.60	**68.28**
Recovery (%)	7.82	9.92	**26.85**

Source: PSMA Report 2013 & Crop Reporting Service, Punjab, 2013-14

FUTURE STRETEGIES

FUTURE VARIETIES OF SRI, FSD

Sr. #	Name of clones	Av. Yield (t ha^{-1})	Yield potential (t ha^{-1})	Sugar Recovery (%)	Remarks
1.	**CPF-249** (S2003-US 704)	107	135	12.80	Medium
2.	**CPF-250** (S2003-US 127)	106	125	12.60	Early
3.	S2003-US 633	105	130	13.50	Early
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

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**

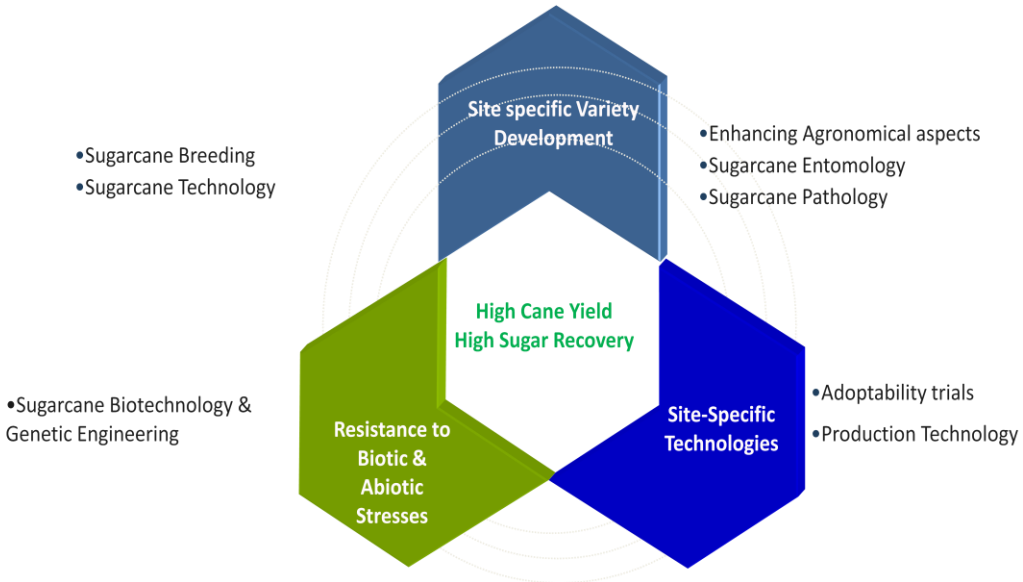
FUTURE THREATS FOR SUGARCANE

BIOTIC STRESSES

ABIOTIC STRESSES

WATER RESOURCES

FUTURE STRATEGIES

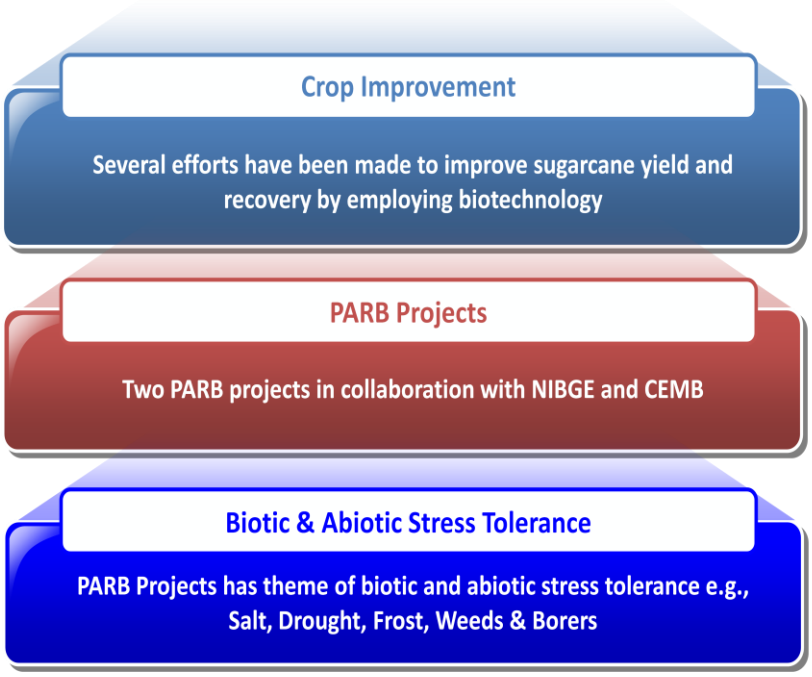


BIOTECHNOLOGY IN SUGARCANE

Abiotic Stresses

Biotic Stresses

SUGARCANE GENETIC ENGINEERING



PARB PROJECTS AT SRI

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

PARB PROJECTS NO 163

Sugarcane plant improvement through traditional and modern breeding technologies

Objectives

- Import of Cane Germplasm
- DNA Fingerprinting at Faisalabad
- Breeding of SRI varieties at Sri-Lanka
- Fuzz Production for High Yield & Recovery Varieties

COLLABORATION

- Shakarganj Sugar Research Institute, Jhang
- Agricultural Biotechnology Research Institute, Faisalabad
- Sugarcane Research Institute, Uda Walawe, Sri-Lanka

ACHIEVEMENTS

- √ Breeding at SRI, Sri-Lanka, 30 varieties of SRI, Faisalabad, 30 varieties of SSRI, Jhang and 30 varieties of SRI, Sri-Lanka were selected based on genetic profiling at ABRI, Faisalabad
- √ More than 500 crosses have been received from SRI, Sri-Lanka, 50 crosses from South Africa
- √ 20 genotypes were exchanged with Philippines and 10 genotypes were exchanged with Mauritius. 34 genotypes were exported to Sri-Lanka during 2014
- √ More than 80,000 seedlings of 293 crosses have germinated, singled and transplanted during 2013-14
- √ Zonal trials of 9 future lines along with 3 standard varieties were planted at 11 locations across Punjab. Three clones performed better than standard varieties

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





SEEDLINGS RAISED FROM FUZZ IMPORTED FROM MAURITIUS

SEEDLINGS RAISED FROM
FUZZ IMPORTED FROM USA

SEEDLINGS RAISED FROM
FUZZ IMPORTED FROM SRI-LANKA

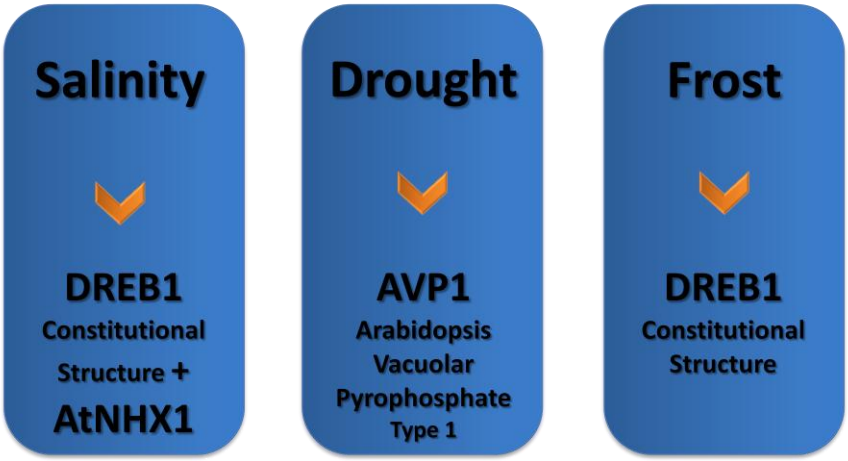
PARB PROJECTS NO 101

Development of transgenic sugarcane (*Saccharum officinarum* L.) against major abiotic stresses

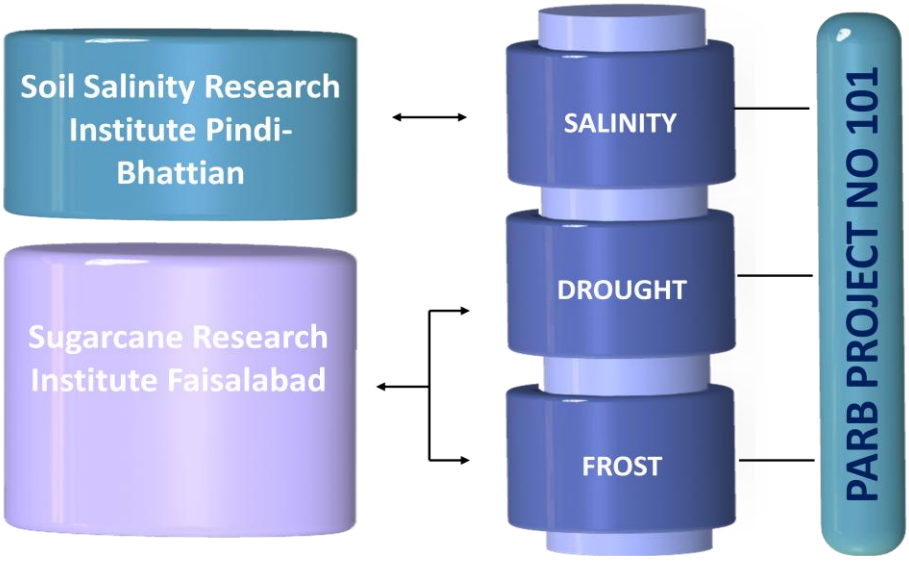
Objectives

- Salt Tolerance
- Drought Tolerance
- Frost Tolerance

PARB PROJECTS NO 101
RESPONSIBLE GENES



PARB PROJECTS NO 101
FIELD TRIALS



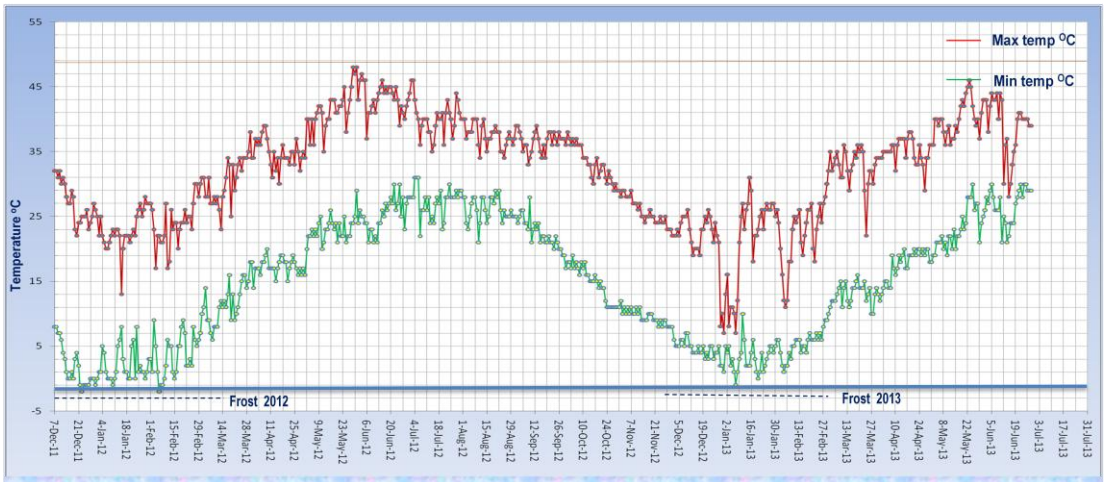
SALT TOLERANT VARIETIES

Water - a scarce commodity

DROUGHT TOLERANT VARIETIES

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

CLIMATE CHANGE



VARIETIES ADAPTED TO BOTH EXTREMES OF TEMPERATURE

ACHIEVEMENTS

- √ Three irrigation levels of 100%, 80% and 60% were applied to 110 clones of CPF-248, CPF-246, HSF-240 and CSSG-668. Seventy seven (77) clones of four varieties performed better on 60% and 80% irrigation
- √ For frost tolerance, 321 clones of CPF-248, CPF-246, HSF-240 and CSSG-668 were tested. Eighty three (83) were selected based on their comparative performance and sown for further testing
- √ The salinity tolerance experiment consists of 91 clones of CP-248 CPF-246, HSF-240 and CSSG-668 sown at SSRI, Pindi Bhattian. All the clones were promoted for second year testing

PARB PROJECTS NO 193

Genetic Improvement of Sugarcane for Herbicide and Borer Resistance

Objectives

- Glyphosate Tolerance
- Borer Resistance

PARB PROJECTS NO 193
RESPONSIBLE GENES

Weeds

GTGene for tolerance against **Glyphosate**

Borers

CEMB-BT for resistance against **Sugarcane Borers**

VARIETIES RESISTANT TO PESTS AND DISEASES

Control measures are not always available or accessible

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

BIOLOGICAL CONTROL

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

Borer

Trichogramma for control of sugarcane borers

Chrysoperla for control of whiteflies

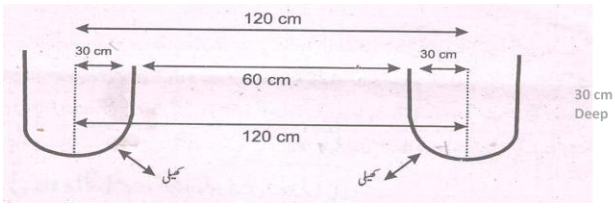
REDUCE COSTS OF PRODUCTION

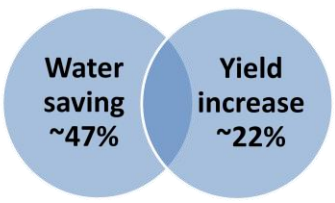
- **IRRIGATION**
  (Improve WUE)

- **FERTILIZERS**
  (Improve FUE)

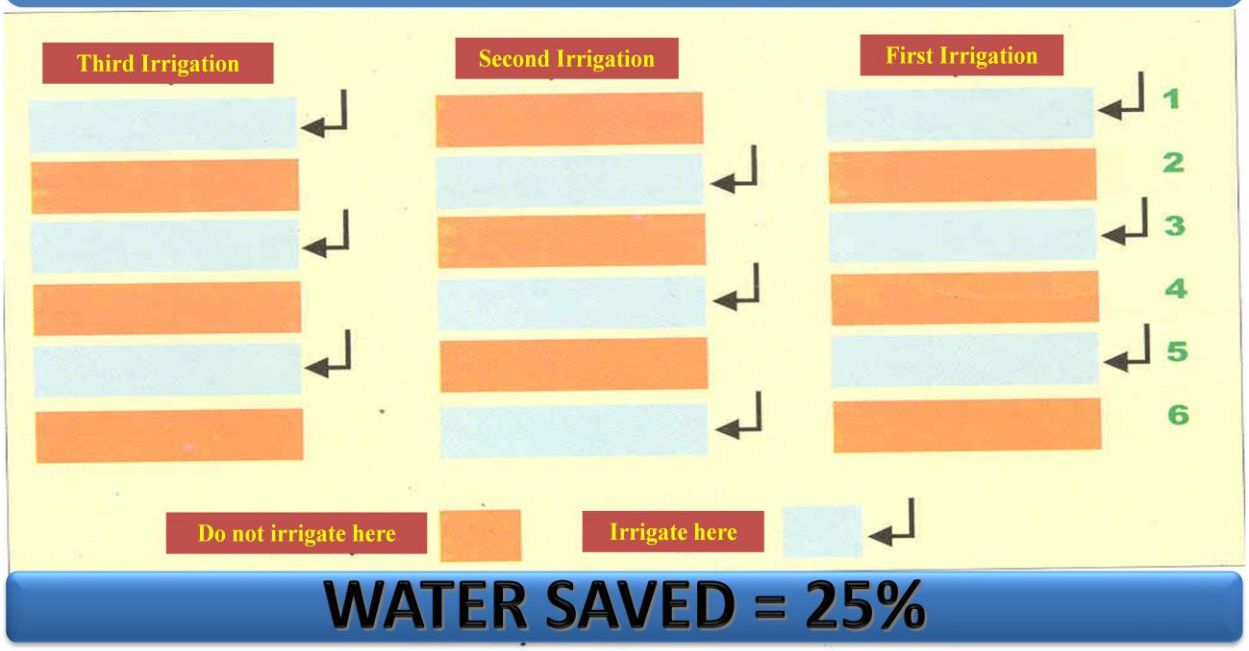
- **HARVESTING**
  (Reduce Losses)

DEEP TRENCH PLANTING TECHNIQUE





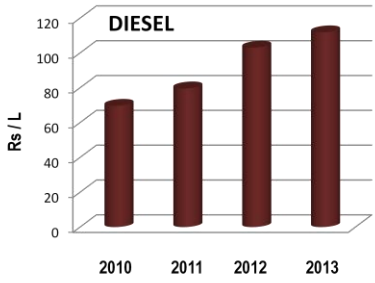
ALTERNATE SKIP IRRIGATION

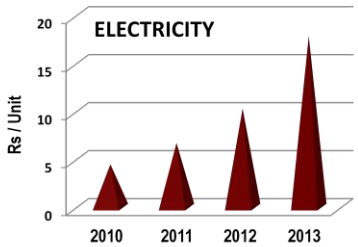


WATER SAVED = 25%

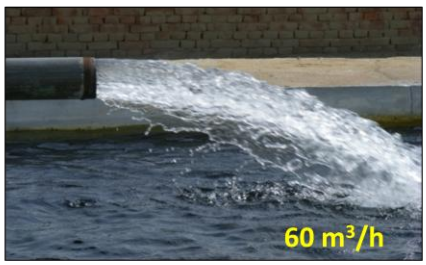
SOLAR ENERGY—RENEWABLE ENERGY

RISING COSTS OF DIESEL AND ELECTRICITY

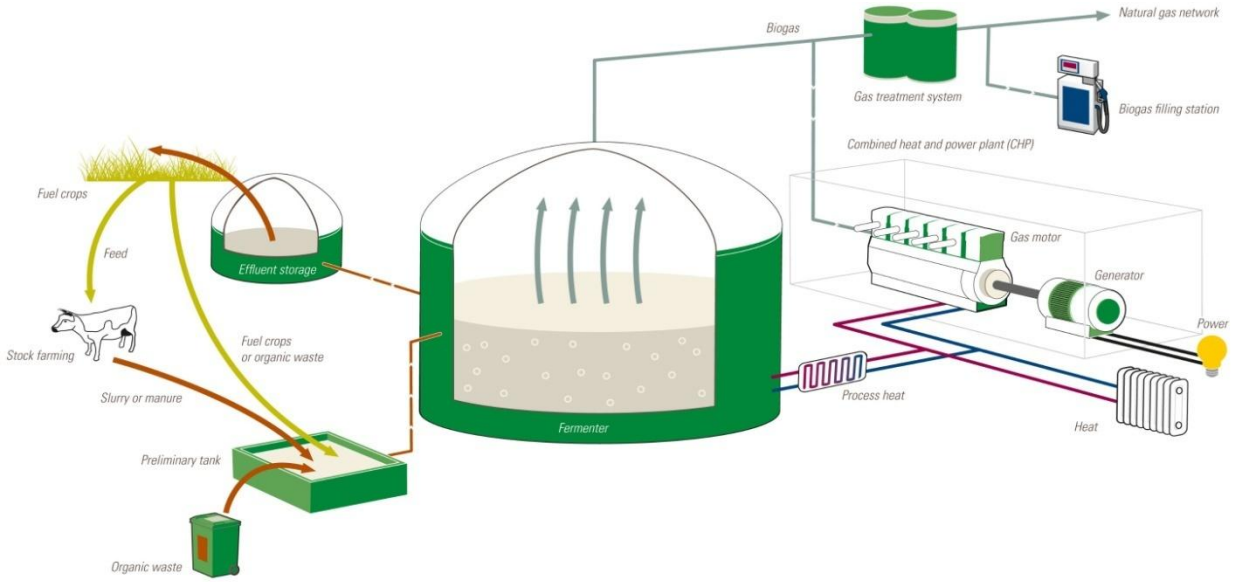




SOLAR POWERED TUBEWELL



BIOGAS - RENEWABLE ENERGY



STRESS MANAGEMENT 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

STRESS MANAGEMENT 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

BIO-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**

FUTURE STRATEGIES

Continuity of fuzz 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

Contd...

FUTURE STRATEGIES

Establishment of Sugarcane Breeding Institute in Coastal area

Establishment of Cane Seed Production Farm at Chak Jhumra

Sugarcane maximization program at mill level

ESTABLISHMENT OF SUGARCANE RESEARCH & DEVELOPMENT BOARD

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

Contd...

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

Contd...

MEDIUM TERM OBJECTIVES (5 YEARS)

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 %**

- 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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