

Sweet sorghum

Dr T.S.Raveendran

Director

Centre for Plant Breeding & Genetics

Sweet sorghum

- Also known as sugar sorghums
- Grown for Ethanol, sugar, jaggery, syrup and silage
- Introduced in USA in 1950
- Chief source of ethanol in USA, Brazil, China, Australia and South Africa
- Stalks are sweet and juicy
- Yields high biomass and fermentable sugars
- Cultivated in kharif, rabi and summer
- Harvested in 90 – 120 days
- Requires less water and fertilizers
- Wider adaptability

Characters of Sweet Sorghum

1. Days to flowering	:	75 – 85 days
2. Days to maturity	:	100 – 115 days
3. Plant height	:	280 – 340 cm.
4. Average cane weight	:	380 – 528 g/plant
5. Cane yield	:	35 – 50 t/ha
6. Grain yield	:	17 – 28 q/ha
7. Juice extractability	:	40 – 50 %
8. Brix	:	16° – 19°
9. Total soluble solids	:	13 – 15.2%
10. Reducing sugars	:	1.3 – 2.1 %
11. Sucrose	:	9.6 – 13.6 %
12. Ethanol yield	:	2500 – 4000 lit / ha

PRODUCTIVITY AND QUALITY OF SORGHUM JUICE

- Quality of juice is slightly inferior to sugarcane
- Trash content is high due to crushing leaves and stalks
- High fibre in juice up to 21.17 %
- Low efficiency of yeast strain
- Biomass yield of 35 – 50 t/ha and ethanol yield of 2500 - 4000 lit/ha

SORGHUM GRAINS

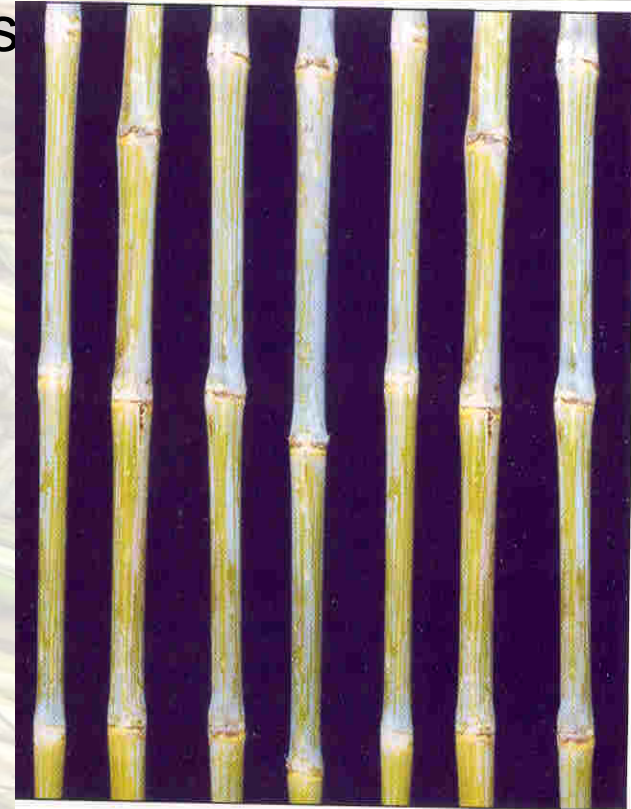
- Rich in starch
- Absence of technologies for industrial uses
- Seagram R & D centre, Maharashtra optimizing the process
- Expensive because of hydrolysis of starch
- Superior quality and potable alcohol

SCOPE FOR SWEET SORGHUM IN TAMIL NADU

- Grown in 3.51 lakh ha with production of 3.46 lakh tonnes with productivity of 984 kg/ha
- 80% grown as rainfed and 20% as irrigated ; irrigated crop in Jan. – Feb. and March- April.
- Area declining due to change in eating habits
- Alternate raw material
- Sugarcane area can be converted
- Requires less water and fertilizers
- Wider adaptability
- Continuous supply of cane to the mill
- More employment opportunities

ETHANOL FROM SWEET SORGHUM VARIETIES

- Potential yield - 80 to 100 t/ha (US reports)
- Longer maturity yield surpasses 100 t/ha
- Ethanol yield
 - 2639 lit/ha (Brazil)
 - 7000 lit (China)
 - 3000 lit (South Africa)
 - 4790 lit (US)
- National variety of India SSV 84 - 40 –50 t/ha bio mass ; 40% of Juice yield and 4500 lit/ha of ethanol (NRCS report)

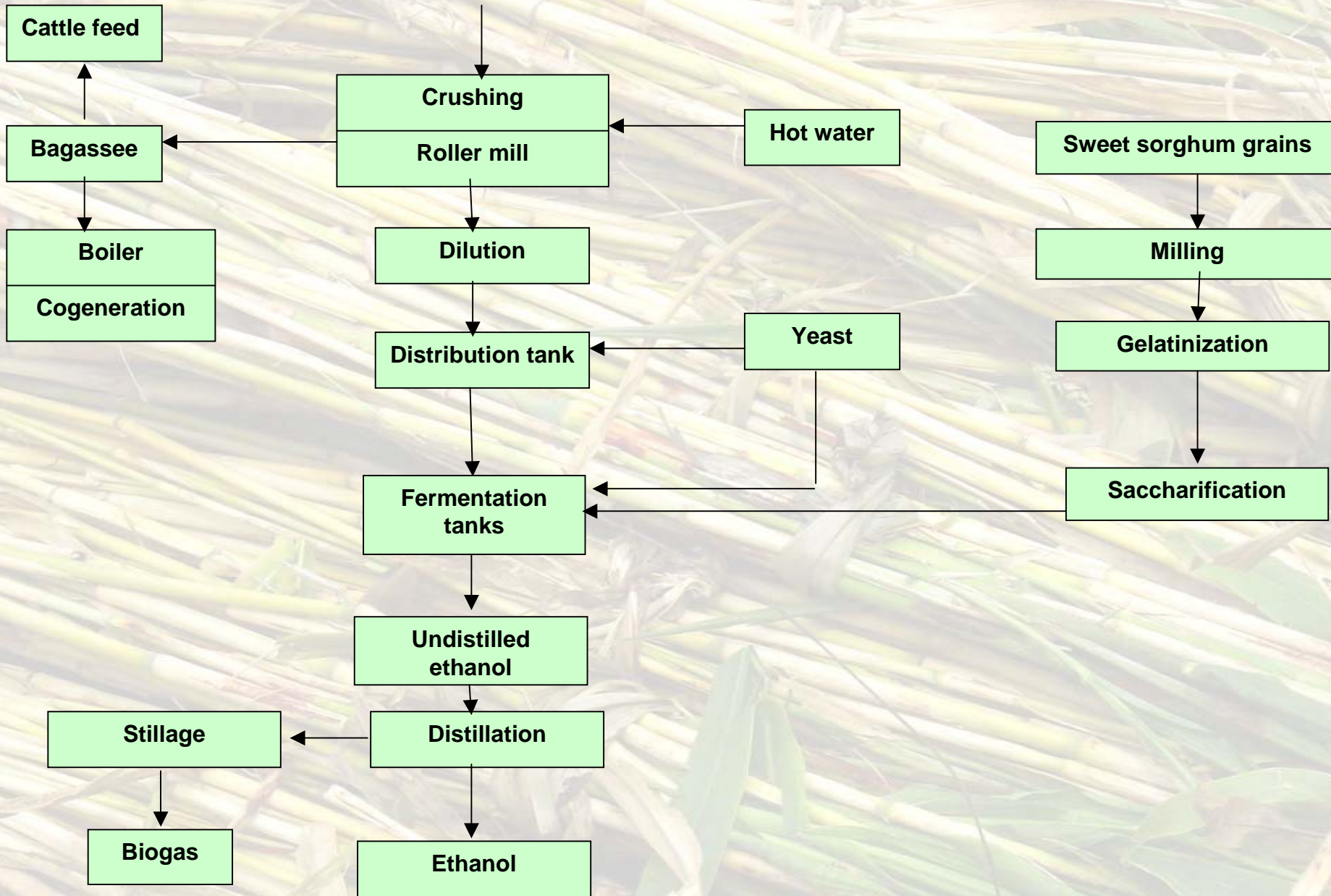


Fuel Properties of ethanol, methanol and petrol

	Ethanol	Methanol	Petrol
Chemical formula	C ₂ H ₅ OH	CH ₃ OH	C ₄ -C ₁₂ hydrocarbons
Molecular weight (g)	46.0	32.0	100-105
Composition, percent by wt			
Carbon	52.2	37.5	85-88
Hydrogen	13.1	12.6	12-15
Oxygen	34.7	49.9	0
Specific gravity	0.794	0.796	0.72-0.78
Density (kg/l)	0.794	0.796	0.72-0.78
Boiling point (°F)*	78°C	65°C	27°C-225°C
Flash point (°F)*	12.8°C	11.1°C	-42.8°C
Latent heat of vaporation (kJ/kg)	845 kg	1100 kg	353 kg
Heat of combustion (MJ / kg)	29.7	22.3	47.0
Stoichiometric ratio	9.0	6.5	14.7
Autoignition temperature (°C)	423	464	257
Research octane number	107	109	93
Road blending octane value	126 (avg.)	130	-

Less Carbon monoxide and Sulphur – environment friendly ; * - safe for transport

Sweet Sorghum (Juice and cane)



SWEET SORGHUM RESEARCH IN INDIA

- National Research Centre for Sorghum, Hyderabad
- AICSIP Centres at Virinjipuram (Tamil Nadu), Akola, Rahuri (Maharashtra), Surat (Gujarat), Pant Nagar (UP) and Palem (AP)
- Nimbkar Agricultural Research Institute (NARI) a non-profit, private organisation, Phaltan, Maharashtra

GENETIC IMPROVEMENT

- **Popular International varieties:** Rio, Dale, Brandes, Theis, Roma, Vani, Ramada and Keller
- **National Variety:** SSV 84 (AICSIP) (Duration: 110 days, cane yield: 43.58 t/ha, grain yield: 1770 kg/ha, juice extractability: 47.1%, brix: 16.5%, sucrose: 11.8%, Ethanol yield: 3500 l/ha)
- **Promising National Cultures:** BJ 248, RSSV 9, NSSV 208, NSSV 255, RSSV 56 (AICSIP)
- **Promising Private Hybrid:** 'Madhura' (Nimbkar Agri. Res. Inst., Phaltan, Maharashtra) (110 days duration, 2 tons of grain/ha, 40 tons of cane / ha, 3500 l of Ethanol/ha)

Promising TNAU variety

VMS 98003

1. Duration : 110 days
2. Green cane yield : 45 tons / ha
3. Grain yield : 2500 kg/ha
4. Juice extractability : 42%
5. Brix value : 18%
6. Ethanol yield : 3650 l/ha

PROMOTION OF SWEET SORGHUM IN TAMIL NADU

TNAU

- Developing high yielding varieties and hybrids
- Developing production technologies for high yield
- Evolving yeast cultures for effective fermentation
- Production of quality breeder seeds (300 metres isolation)
- Training the extension staff / cane officers

Department of Agriculture

- Technology transfer to the farmers
- Production of foundation and certified seeds
- Distribution of inputs to the farmers
- Training farmers on sweet sorghum cultivation



Ethanol Industry

- Identification of farmers
- Transfer of technology
- Seed production and distribution
- Collaboration with TNAU in R&D