



# Sweet Sorghum

A water saving, bio-energy crop for the Philippines



## Bio-fuel and feedstock

- Soaring prices of fossil-fuel and environmental pollution associated with its use, have resulted in increased worldwide interest in the production and use of bio-fuels. Both developed and developing countries have a common concern, which has triggered public and private investments in bio-fuel crop research and development, and in production of bio-fuel.
- Many developing countries including India have made it mandatory to blend petrol with ethanol. Large quantities of ethanol are needed to meet current and future blending requirements.

## Sweet sorghum

- Sweet sorghum [*Sorghum bicolor* (L.) Moench] is similar to grain sorghum with sugar-rich stalks. Being a water-use efficient crop, sweet sorghum has the potential to be a good alternative feedstock for ethanol production.

## Comparative economics of sweet sorghum-based ethanol production

- Cost of producing one liter ethanol from sweet sorghum is lower than that from sugarcane molasses (the most commonly used feedstock for ethanol production in India and other countries).
- In addition to sweet-stalk cane yield, sweet sorghum provides a grain yield of 2 to 6 t ha<sup>-1</sup>.
- The stillage from sweet sorghum after extraction of juice has higher forage value (rich in micronutrients and minerals). Thus, food/fodder requirements of small-holder farmers will not be compromised if sweet sorghum is used for ethanol production.
- Ethanol production process from sweet sorghum is less polluting than sugarcane and the resulting ethanol has clean burning quality with high octane rating.

## Sweet sorghum research at ICRISAT

ICRISAT's two-pronged strategy

- Developing improved hybrid parents and varieties
- Facilitating incubation of sweet sorghum-based ethanol production technology by prospective entrepreneurs.

## Progress in research

- Several promising varieties-NTJ 2, SPV 422, Seredo, S 35, ICSV 700, ICSV 93046 and ICSV 25263 have been identified.
- Several promising hybrid seed parents-ICSB 729, ICSB 722, ICSB 321, ICSB 474, ICSB 480, ICSB 766, ICSB 479 and ICSB 453 and restorers-ICSR 93034, SP 4487-3, SPV 422, SP 4484-1, SSV 53, SP 4482-2, SP 4481-1, SP 4482-1 have been identified.
- Developed hybrids that are relatively less photoperiod and thermo sensitive and early maturing compared to varieties.
- Several promising sweet-stalk hybrids have also been identified. The performance of some of the sweet sorghum hybrids is better than the best control hybrid (Table 1).



SPV 422 - A promising sweet sorghum variety.



Dr William D Dar, Director General, ICRISAT, inaugurates Rusni Distilleries Ltd in Oct 2006.



Team ICRISAT visiting Rusni Distilleries Ltd.



Rusni Distilleries Ltd, India.

**Table 1. Performance of sweet sorghum hybrids during 2006 rainy season, ICRISAT, Patancheru**

Hybrid	Days to 50% flowering	Cane yield (t ha <sup>-1</sup> )	Juice yield (t ha <sup>-1</sup> )	Brix reading at maturity	Grain yield (t ha <sup>-1</sup> )	Per day ethanol productivity (l ha <sup>-1</sup> )*
ICSA 24001 x SSV 74	85	57.8	28.3	18.0	5.0	27.2
ICSA 38 x ICSV 700	82	52.5	29.1	15.5	6.3	25.6
ICSA 475 x SSV 74	82	52.4	26.3	16.3	5.6	25.5
ICSA 702 x SSV 74	83	50.1	24.2	16.8	4.7	24.1
NSSH 104 (Check)	91	50.1	20.4	17.2	1.8	22.0
Mean	83	35.0	16.9	15.7	4.6	16.9
CV (%)	1.8	23.1	18.4	10.9	22.5	-
CD (5%)	2.4	13.0	5.0	2.8	1.7	-

\* Ethanol productivity estimated at 40 liters per ton of millable cane yield

## Second-generation ethanol

- Cereal stover, including that of sorghum, contains lignin, cellulose and hemi-cellulose that can be used to produce ethanol.
- Brown midrib sorghums (contain 50% less lignin) require less energy for conversion into ethanol. ICRISAT is developing high biomass brown midrib sorghums for ethanol extraction.



*Brown midrib sorghum for second-generation ethanol production.*

## ICRISAT-Philippines ties

- Initially limited to sharing germplasm for grain and fodder
- ICRISAT's initiatives led to identification of several varieties and hybrid parents with high sweet-stalk yield
- Eight sweet sorghum varieties shared through the Cereals and Legumes Asia Network (CLAN)
- A total of 157 seed samples of sweet sorghum hybrid parents and varieties supplied to different organizations in the Philippines; hybrid development program can be initiated with these parents
- SPV 422, a promising multipurpose (food, fodder, and sweet stalk) and multi-season (rainy and postrainy) variety performed well in the Philippines (Table 2)
- Bulk quantities of sweet sorghum varieties supplied to Mariano Marcos State University (MMSU), Philippines – SPV 422 (110 Kg), ICSV 700 (105 Kg), ICSV 93046 (110 Kg) and ICSR 93034 (110 Kg) for multilocation evaluation
- Large-scale testing of sweet sorghum varieties is slated to begin in 2007; led by MMSU, Philippines.



*The Ambassador of the Philippines in India views sweet sorghum stalks.*

**Table 2. Sweet sorghum varieties tested at MMSU, Philippines**

Variety	Stripped stalk yield (t ha <sup>-1</sup> )		Grain yield (t ha <sup>-1</sup> )		Percentage sugar by Brix meter
	Seed crop	First ratoon	Seed crop	First ratoon	
NTJ 2	45-50	48-55	3.62	4.40	18.5
SPV 422	55-60	57-65	3.28	3.92	19.0
ICSV 700	43-48	45-50	3.46	4.11	18.0
ICSV 93046	47-52	48-55	3.40	4.08	15.0

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## About ICRISAT®

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 600 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Centers of the Consultative Group on International Agricultural Research (CGIAR).

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