



Biofuels Research at ICRISAT

The crop link to renewable energy



Biofuel from Sweet Sorghum

Need for alternate raw material

Policies to blend petrol with up to 10% ethanol are widely adopted globally, which led to additional ethanol requirement – 0.5 million t in 2006 in India alone. Existing feed stocks, such as sugarcane/sugarcane molasses, are unlikely to meet actual demand. Therefore other options have to be sought, and it was found that sweet sorghum has very good potential as a feedstock for ethanol production.



Team ICRISAT with a farmer in his sweet sorghum field.

Advantages of sweet sorghum

Sweet sorghum [*Sorghum bicolor* (L.) Moench] is similar to grain sorghum with a sugar-rich stalk comparable to sugarcane. It has wide adaptability and grows rapidly. In recent years, there is an increased interest in the utilization of sweet sorghum for ethanol production in India. Its growing period and water requirement are 4 times lower than that of sugarcane. Sweet sorghum is best suited for ethanol production because of its higher reducing sugar content as compared to other sources. These important traits, along with its suitability for mechanized crop production and seed propagation makes it the best alternative source of raw material for ethanol production in India.

From an economic and environmental point of view

The cost of per liter ethanol production from sweet sorghum grain and juice is lower than that from maize and sugarcane, respectively. The stillage from sweet sorghum is rich in micronutrients and minerals, and can be used as fodder or for cogeneration of power. Ethanol being a 'clean burning fuel' with high octane rating, existing automobile engines can be operated with gasohol – petrol blended with ethanol (upto 25%) – without any need for engine modification.

Sweet sorghum research at ICRISAT

ICRISAT's strategy is two-pronged: one, by developing sweet sorghum varieties, hybrid parents and hybrids in partnership with National Research Systems (NARS); and two, by facilitating the private sector to incubate ethanol production technology through the Agri-Business Incubator (ABI), the technology commercialization wing of ICRISAT.

Technology sharing and incubation

- The seed of improved cultivars shared with National Agricultural Research Systems
- ICRISAT, through ABI, facilitated Rusni Distilleries Ltd., India, in the commercial production of ethanol from sweet sorghum
- Several delegations from China, Philippines, Japan, and Nigeria have visited ICRISAT for fostering research and business alliance for sweet sorghum-based bio-ethanol production.

Apart from sweet sorghum, ICRISAT is also working on improving the biomass of brown-mid rib sorghums, as the stover from such sorghum have a great potential to produce ethanol.



The DG, Dr WD Dar and other dignitaries at the inauguration of Rusni Distilleries.

Biodiesel Plantations

Background

The rapid depletion of world fossil fuel reserves, the unprecedented rise in diesel prices, along with increased consumption and vulnerability in the supply chain presents an ideal window of opportunities for biodiesel / biofuels. Several attempts have been made to use edible and non-edible oils in compression ignition for different utilities. But developing countries cannot afford to use edible oils as a power source; but non-edible oils, such as



Jatropha fruit.

Ten-year-old Pongamia tree.

etc, can be strategically propagated. *Pongamia pinnata* (karanja) and *Jatropha curcas* (ratanjot) could form the basis of a self-sustaining agricultural platform that could breathe new life into villages.

Ideal as biofuel

Pongamia and Jatropha seeds contain 25-40 percent oil. This biofuel requires very little or no modification of automobile engines when blended with diesel up to 20% (B20). It also results in substantial reduction of unburned hydrocarbons by 30%, carbon monoxide by 20%, and particulate matter by 25%. Moreover, sulphur content is negligible.

Biofuel research at ICRISAT

Research activities at ICRISAT have generated much valuable knowledge. Some of the important results of this research are as follows:

- Seed has been collected from high-yielding trees of Pongamia and Jatropha from different states of India, and the germplasm thus collected was evaluated for oil content, growth and yield.
- Decentralized oil extraction and generation of electricity has created employment opportunities in the village.
- After oil extraction, the byproduct makes an excellent fertilizer.
- New institutional arrangements are tried out for sustainable development through biodiesel plantation.
- Biodiesel also reduces environmental pollution.
- The tribals from Powerguda have learned to use Pongamia as a means of improving livelihoods and coping with drought and migration.
- It has further led to a public-private partnership between ICRISAT and GTZ.



Pongamia seeds, oil, and its by-product, cake.

In conclusion

As limited information exists about biodiesel there is an urgent need to undertake advanced research on all aspects of this vital new avenue, given the needs of developing countries. The knowledge thus acquired can then lead to better application and implementation.



About ICRISAT®

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a nonprofit, 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).

ICRISAT-Patancheru (Headquarters)
Patancheru 502 324, Andhra Pradesh, India
Tel: +91 40 30713071, Fax: +91 40 30713074
Email: icrisat@cgiar.org, Website: www.icrisat.org

