Biofuel Crops: Power to the Poor

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Developing nations are looking towards biofuels to help reduce their spiraling foreign oil import costs, and to mitigate pollution and global warming. The drylands, often neglected compared to more favorable areas, can contribute importantly to a bio-fueled future. Our challenge—and opportunity—is to ensure that the dryland poor are not left behind.

Bio-ethanol: an idea whose time has come

Contrary to common belief that massive subsidies are needed to promote bio-ethanol, it is now price-competitive with petrol (gasoline) in India without subsidies, due to recently skyrocketing petrol prices. This is the case even after adjusting for energy-equivalency (one liter of petrol has the same energy content as 1.5 liters of ethanol). India is targeting a 10% blend of ethanol in its national petrol supply.

The constraint is not the cost of ethanol production; it is the supply of raw materials. This is where ICRISAT and partners come in.

Sweet, sweet sorghum

Most bio-ethanol in India is produced from the molasses left over from the refining of sugar from sugarcane, but the supply of molasses is insufficient and not reliable enough for costly ethanol production facilities that need to keep working around the clock to pay off. We are excited about the potential of a little-known dryland crop, sweet sorghum, to help fill this supply gap. 'Sweet' varieties of sorghum store large quantities of energy as sugar in their stalks, while also producing reasonable grain yields.

Sweet sorghum: breeding biomass for biofuel.

Sorghum, like sugarcane and maize, exhibits C_4 metabolism – making it more efficient at converting atmospheric carbon dioxide into sugar than most plants. As a dryland crop, sorghum requires far less water than costly irrigated sugarcane, making it more accessible to the poor. The juice squeezed out of sweet sorghum stalks contains about 15-20% sugar that can be fermented into ethanol more cheaply than from sugarcane molasses—and with even greater energy savings compared to maize grain, which has to be hydrated and converted from starch to sugar before it can be fermented.

After crushing the stalks are excellent for cattle fodder or to fuel the ethanol production facility.

India's National Research Centre for Sorghum (NRCS) has long recognized the potential of sweet sorghum and has developed excellent open-pollinated varieties and some hybrids. Our complementary contribution has been the identification of high-sugar parent lines for hybrid breeding from our global germplasm collection (another payoff from that immensely valuable resource). Hybrids are also less photoperiod sensitive so they can be grown year-round, smoothing out supply variations for the ethanol production facilities.

Making it happen

We are stimulating public-private collaboration to move sweet sorghum from a good idea on the shelf, to impact on the ground. Our hybrid sorghum program receives substantial support from the private sector (30 seed companies) through our innovative Hybrid Seed Consortium, so the seeds are moving quickly through the research-to-development pipeline.

ICRISAT works closely with Rusni to deliver on sweet sorghum's promise.

At ICRISAT Headquarters in Patancheru, India we've also formed a public-private partnership with Rusni Distilleries (P) Ltd. Rusni ensures that seeds of the highest-sugar sorghum varieties identified by ICRISAT and NRCS reach farmers so they can increase their productivity. Rusni also helps farmers by transporting the stalks from farms within a 30 kilometer radius of the plant, and providing more distant farmers with technologies to crush the stalks and reduce the juice into syrup that can be moved cost-efficiently to the ethanol production plant. Lessons we are learning from this partnership will enable the technology to scale up faster and more widely in the coming years.

Bio-diesel

Forty percent of India's oil imports are consumed in the form of diesel fuel, and demand is rapidly growing. The nation has adopted similar blending targets as for bio-ethanol (10%). Bio-diesel is even more environment-friendly than bio-ethanol because it requires less energy to process. It is also much less polluting than fossil-fuel diesel.

As in the case of bio-ethanol, the biggest constraint for takeoff of the bio-diesel industry is insufficient supply of the raw material. To fill this gap, vast wasteland areas, estimated at 38 to 187 million hectares

in India, that include areas suitable for dryland-hardy bio-diesel crops can be made available to local communities. While providing an income-earning opportunity for the poor, these perennial tree and shrub crops also help rehabilitate these lands by building the fertility of their soils.

Japtropha grows vigorously in dryland Africa; note the oil-rich fruits.

Two contrasting dryland species are especially interesting: *Pongamia pinnata*, a leguminous tree adapted to wetter wastelands with problem soils; and *Jatropha curcas*, a more drought-tolerant shrub adapted to well-drained wastelands and widely grown as a homestead boundary plant in the Sahel. Both produce fruits containing about 35% oil suitable for bio-diesel.

Women are the main cultivators and processors of bio-diesel crops at the village level. ICRISAT is working with poor women united in self-help groups to start Pongamia enterprises in remote tribal areas of Andhra Pradesh, India, and working with India's national research system to identify high-oil varieties as well as better cultivation methods.

Poor tribal women in India earn income from sales of Pongamia seedlings.

India is also promoting Jatropha; it is grown along rail lines and the oil is blended with petro-diesel to power trains. Japtropha is also widely grown as a hedgerow boundary plant in Indian and African villages. We are exploring the genetic variability in Jatropha on both continents to find higher-oil types to increase its income-earning potential.

A future of possibility

Some question whether biofuel crops will compete for land with food crops, driving up food prices. To be sure, there are risks; however we look at this issue differently.

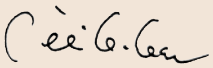
The dryland poor need food to eat, but they also need opportunities for economic growth if they are to escape poverty. Sorghum production in India has been declining for many years due to urban preferences and subsidies for rice and wheat, lessening economic opportunities for dryland agriculturalists. The same trends will probably develop in Africa in decades to come. Increases in area sown to corn or sugarcane for ethanol, in contrast would take the most valuable, fertile lands out of food production.

Through research-for-development, we can help transition the sorghum enterprise from a human food to a cash crop for bio-ethanol as well as producing grains and stalks that feed humans and livestock. We can help rural villages gain greater self-sufficiency in energy production through bio-diesel crops. The benefits are multiple and significant: easing poverty, reducing air pollution, mitigating global warming, and rehabilitating degraded wastelands.

Biofuels are a major emerging trend that can have a large impact on dryland development. Now, in the early stages, is the time of greatest opportunity to ensure that the poor capture a large share of the benefits. Raw materials are a key constraint that we are helping to overcome in a pro-poor manner through our dryland crops expertise and partnerships with investors, governments, non-governmental organizations and the private sector.

Many twists and turns still lie ahead of us on this road, but I am confident that with your support and partnership we will be able to power a better future for the drylands through biofuels.

Sincerely yours,



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Science with a Human Face

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 Future Harvest Centers of the Consultative Group on International Agricultural Research (CGIAR).

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