



# Sweet Sorghum an alternative energy Crop



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*Case study of Brazil*

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Composition of the consortium

**CIRAD**  
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# SweetFuel Project

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## Ethical Issues – the case of Embrapa and some personal considerations

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The present report focuses the case of Embrapa as a partner of the SweetFuel Project. The procedure adopted was the formulation of questions that served as reference to an interview with Rafael Parella (in 3/25/2013). A first draft containing the responses was then prepared, and submitted to his revision and complementation (in 4/14/2013).

This version has been organized into topics, each one of them corresponding to an specific question of the interview. The interviewed researcher provided all the information presented here, apart from the **Final Remarks**, which synthesize the main findings and considerations, as a contribution to the SweetFuel Project team.

### **1. Access to genetic material: Sweetfuel as a facilitating mechanism for exchanging genetic material for the purpose of increasing the diversity available to research programs.**

There was an exchange of germplasm among partners of the project: Italy, France and Germany. Mexico and India have not provided their material (to date). Embrapa provided the material to the partner who has requested (India).

*Material transfer agreement* - MTA is an instrument for the transfer under conditionality.

In practice, the Embrapa team has transferred its material (available from studies of the 1970s). The material received from partners is under study in the field and in “vegetation houses”

The seeds were introduced in Brazil via MTA, through Cenargen-Embrapa, which is the instance responsible for this type of import, according to standards procedures.

There was a period of quarantine.

### **2. Precautions, safety in the laboratory, and control of risks of leaks (*in situ* and *ex situ*)**

The introduction of plagues and diseases can be a risk, but Cenargen and other international institutions working on germplasm exchange (plagues, diseases, quarantine...) assess this possibility.

It can occur that sweet-sorghum seeds mix with other species sorghum, but if the production fields are well controlled, this risk is reduced.

In the case of disseminating the seeds by commercialization, the prospect is that producers will harvest their production directly for the market.

The risk of gene flow is small, usually because there is already interaction between the types of sorghum, including wild sorghum (which is common in some regions in Brazil). The genetic material transferred is not GMO.

### **3. Exchanges with national partners**

There are exchanges, but for the use as technology transfer, and not for the development. In 2011/2012, four ethanol plants planted sorghum areas with Embrapa seeds. In 2013, that number was reduced to three. In all those years the varieties developed by Embrapa showed advances both for the production of ethanol and for market purposes (commercial cultivars in the private sector). The seeds are already being produced by seed breeding companies under licence for the market and are being sold. Embrapa agronomists provide technical assistance to the private producers, under specific contracts.

For the development of new material there is no partner to date, although there are contacts going on.

### **4. Exchanges with international partners**

Results are presented annually, during the meetings of the project. Exchanges are reciprocal and very enriching.

### **5. Contracts**

Contracts are signed only with seed breeding companies (licensing cultivars) and ethanol plants (technical assistance in the cultivation of sweet sorghum).

### **6. Experimental producers and their risks**

The ethanol distilleries took risks, since the beginning, in 2011 and 2012, when they started cultivating sweet sorghum in their production areas (20,000 ha in the first year and then 10,000 ha in the second).

### **7. Prior clarification about risks they were taking**

This is an usual procedure. But as tropical agriculture is based on short cycle crops, a culture such as sweet sorghum is risky (from the climatic and phyto-technical points of view). Assessments showed that sweet sorghum works well in a sugar-cane distillery, and this was understood as a positive feature. However, some producers reached only a low productivity of ethanol per hectare (<1,500 l/ha, while it is necessary al

least 2,500 l/ha to be viable). Embrapa's cultivars reached 2,500 l/ha. The low rate of productivity provoked frustration. That's why in the second year the extension of fields was reduced.

#### **8. Dissemination of results to smallholders and large-scale producers**

To date, only large-scale farmers have adopted sweet-sorghum production because they are the ones who are capable to self-finance their production.

Technically it is applicable to small-scale production. There is already a bank line of credit for sweet sorghum, but it is not yet disseminated.

The production sweet sorghum for ethanol plants can increase as a proportion of 20% of the total area cultivated with sugarcane (fallow areas).

#### **9. The type of farming practiced by those who are now planting sweet sorghum before**

The sweet sorghum cannot compete with the profitability of soybeans and corn. Therefore, it is still restricted to areas of renovation cane and degraded pasture areas (although in this case with low productivity to sweet sorghum).

#### **10. Risks of replacing food / feed for fuel**

The case of Brazil is quite unique because it is possible to intensify the productivity of grazing areas and then use the liberated areas for bio-fuels.

#### **11. Commercialization of seeds (selling) vs. distribution (free)?**

Embrapa licenses and seed breeding private companies sell.

#### **12. Governmental instruments to support and foster the production of sweet sorghum**

Banks are starting to finance the production of sweet sorghum.

#### **13. Prospects: extending sweet sorghum to small-hold farmers**

This is possible, via financing cooperatives and farmers associations. Sweet sorghum is recommended for the production of ethanol, but it demands a distillery. This demands considerable investments. A small producer individually cannot cope with the costs, unless when supported by a bank loan. A possibility could be micro-distilleries owned by associations or cooperative of smallholders.

#### **14. Risk reduction of food production in the small-scale farms**

The initial idea is that sweet sorghum can occupy part of the sugar-cane areas, which are in renovation. This means utilizing the same areas already used for the production of bio-energy, and not competing with the production of food. Sweet sorghum requires more phyto-technical care than traditional crops. At the current yield pattern it still does not compete with food.

#### **15. Strategies for the future: growing area, focus, coordination with other productions, commercial profitability**

The trend for sweet sorghum is stabilizing as a complement to sugarcane in renewal areas. Suppliers of ethanol plant tend to join the market of sweet sorghum: there are 8 million ha of sugarcane in Brazil. 20% of 8 million is the limit, considering the percentage of annual renewal of the crop. It is estimated that 1/3 of the area in the near future can adopt sweet sorghum (500,000 ha).

#### **16. Prospects for sweet sorghum as a priority at Embrapa**

The first priority is to develop cultivars with higher yield potential. The second is to develop production systems as a whole (from planting to harvesting and commercializing seeds). Market takes care of the dissemination.

#### **17. Ethical aspects of research and publication of results**

##### a) Students involved

There are masters' thesis and PhD's dissertations on sweet sorghum being developed at Embrapa.

##### b) Property rights

The knowledge generated belongs to Embrapa. In the case of commercialization by private companies, there are contracts with Embrapa, assuring the property. Licences are preceded by a public bid, where seeds enterprises compete for the licences to cultivate. The competitor that reaches the best rank, according to the items pre-defined, will be the winner and will have to pay royalties to Embrapa, proportionally to the amount of seeds commercialized (something around 5%). Each actor or group of actors working in the development of a cultivar/lineage has the rights on it. As Embrapa works only in the development, it has the rights on the material.

##### c) Publishing articles

There are possibilities with other partners of SweetFuel.

##### d) Pamphlets and/or manuals

There are already some initiatives in this sense, with the focus on producers.

e) Videos

One of them has already been shown in the last annual meeting of Sweetfuel.

f) Dissemination events

“Farmers days”, annual thematic seminars, congresses.

**18. Contractual relationship with partners (marketing, royalties, property rights)**

Embrapa is the owner of the research results it produces.

**19. General questions about the consortium SweetFuel**

a) Who learns from whom?

All are learning, although not all are teaching.

b) Who teaches who?

Embrapa has solid experience and is used to this type of procedure and protocol. This minimizes risks of frustration.

The fact that Embrapa had an experience from 1975 to 1980 was a guarantee for its participation in the SweetFuel project.

c) Restitution of results (to farmers who have participated in experimentations)?

Embrapa has learned from producers (ethanol plants). E.g.: transportation is a major problem and this was only noticed in practice. Embrapa conveys the experience of one producer to the other.

d) Alerting users about possible implications?

This is done during the transfer process. There are the usual risks of any grain crop in the tropical region: rainfall, climate, and soil erosion.

**Final Remarks**

Ethical issues have been a constant remark since the kick-off meeting of Sweetfuel Project, in 2009. My original strategy was to act in a pedagogic manner, by presenting the range of aspects that could be placed in the slot of ethics. Since then, there has been an interaction with the different teams and consultations on their views about typical ethical problems.

Following common sense and evaluation procedures, the assessment took into consideration three moments, as follows:

1. Upstream, i.e. aspects related to the activities previous to the research activity (such as informed consent of farmers who provide information and genetic material, or contracts assuring them a fair participation in the benefits generated by the SweetFuel Project): in this case, no ethical obstacle or fragility has been detected so far.
2. Ongoing, i.e. property rights, authorship credits, sharing of genetic material, or following national regulations: no evidence of ethical problems has been noticed so far. However, there is still this possibility, as common publications have not yet been dealt with. One aspect that deserves consideration is the property rights of knowledge produced by one partner, from the development of material previously developed by other partner. This issue seems to be not very clear and can engender further misunderstandings. But this problem is more related to contracts and/or juridical departments than to the ethics.
3. Downstream, i.e. undesirable or unexpected implications to the farmers (economical, food security, cultural) and to the environment. These are problems that can only be detected after the conclusion of the project, when its results will be applied in a larger scale. It is strongly recommended that the European Commission provide a follow up ex-post of such aspects. In other words: from the ethical point of view (but also from the economic and environmental ones), the real outcome of the project can only be measured some years latter.

#### Some personal impressions:

1. There is a great integration of the various teams involved in the project, so that a common experience can be considered as an important outcome.
2. However, it seems that the daily activities are carried on in a rather independent manner. Each partner has its own dynamics, practices, focus and commitments. This is a normal situation, but for the purposes of the project can lead to a deviation from its original objective: fuel from sweet sorghum.
3. The scenarios foreseeable at this stage are rather different, according to each partner. Brazil tends to respond positively to the fuel production objective; Mexico tends to focus on feed; India tends to focus on food (industrial uses) and feed.
4. There is a clear bottleneck as understood, for instance in the Mexican case, in terms of public incentives. Public policies are an essential aspect for the fostering of such a strategy. The Brazilian case can be considered as a reference. Public decisions have promoted, since the 1970's, the ethanol industry. And when these incentives shrank, the whole ethanol chain also shrank.
5. It is not very clear that the economic viability of the adoption of sweet sorghum under the real conditions of production (at different scales) is confirmed. Experimental fields are not the same than the production for the market.
6. The effective outcome of SweetFuel Project depends on an interdisciplinary approach: public policies, economic aspects, research, technology (the development of equipments suited to specific characteristics), cultural aspects of farmers and their expectations, environmental impacts, changing climate conditions, infra-structure etc.

#### Some questions:

1. How are joint publications (cross-teams) been managed?
2. How to deal with the property rights of cross-teams developments?
3. How are further steps and collaborations (post-SweetFuel) being considered?
4. Is the climate change a common issue? If yes, there are opportunities for further studies (adaptation).
5. How are environmental impacts (positive and negatives) on the long run being considered as a cost-benefit analysis component?
6. Is there an effort to assess the carbon footprint of sweet sorghum at different scales of production?
7. Are there evidences about food vs. fuel competition?

A final question:

How frustrating would it be if SweetFuel ends up more as an overall sweet sorghum improvement, and less as an overall biofuel production practice?