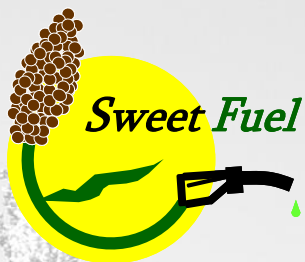


# Sweet Sorghum as an alternative energy crop: Results from SWEETFUEL



*Serge braconnier*  
*SWEETFUEL Consortium*

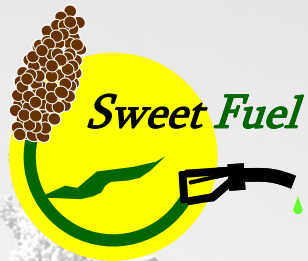




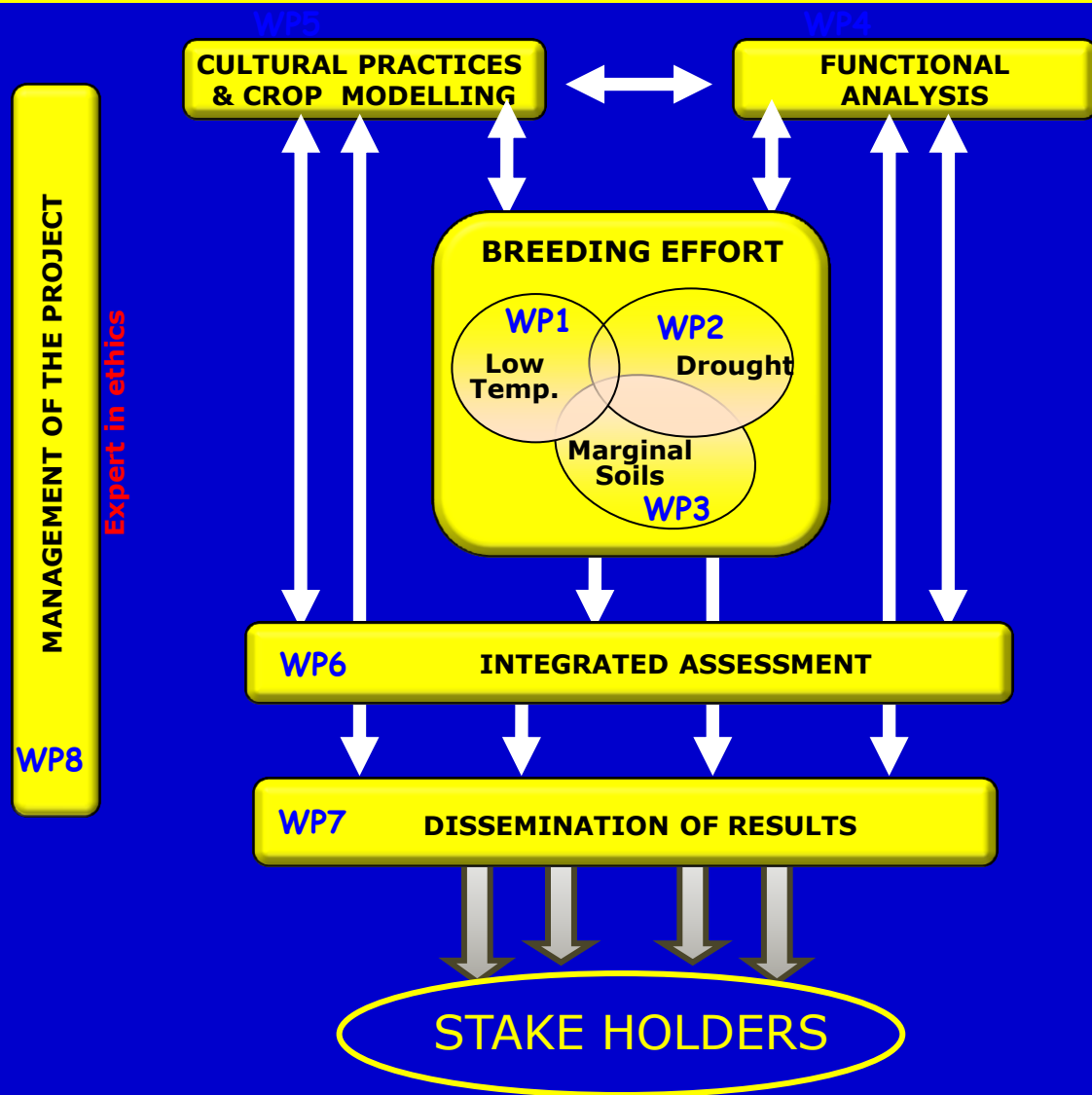
# SWEETFUEL project

- FP7 project co-funded by the European Commission
- Total budget = 5 M € for a EC contribution of 3 M
- 5 years duration + 6 months (01/2010 – 06/2014)
- 10 partners from 7 countries and 3 continents:

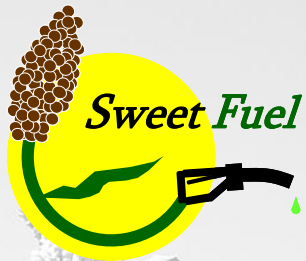
France:	CIRAD
Germany:	KWS – IFEU – WIP
Italy:	UniBO – UCSC
Brazil:	EMBRAPA
India:	ICRISAT
Mexico:	UANL
South Africa:	ARC-GCI
- objective: development of ethanol production from sorghum in temperate and semi-arid tropical zones through genetic enhancement and improvement of cultural and harvest practices
- 91 deliverables
- site web: [www.sweetfuel-project.eu](http://www.sweetfuel-project.eu)



# Work organization







# Results of SWEETFUEL

## New sorghum lines or hybrids

### For temperate zones:

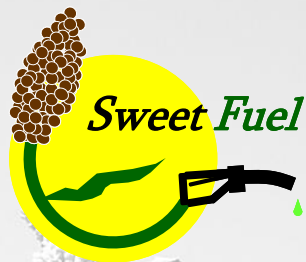
New male lines for hybrid biomass sorghum

New female A/B early lines for hybrid biomass sorghum

New female A/B lines with low lignin content

### For semi-arid tropics:

- In Brazil, 4 sweet sorghum varieties are available at commercial level BRS 506, BRS 508, BRS 509 et BRS 511
  - In India, new hybrids adapted to different cropping seasons are available ICSV 93046, ICSV 25311 + ICSV 25308 adapted to a terminal stress and ICSV 25300 adapted to mid-cycle stress
  - In Mexico, 5 dossiers were submitted to record new sweet material in the national catalogue
  - In South Africa, 5 sweet cultivars are available
- + material for further breeding programmes (RILs...)



## EXPLOITABLE FOREGROUND

### New Sweet Sorghum Cultivar – BRS 508

#### Explanation and Purpose

BRS 508 is a variety developed by Embrapa Maize and Sorghum to meet the growing demand for complementary feedstock as an alternative to sugarcane for ethanol production. This cultivar has high yield potential of stems (average 50-70 t ha<sup>-1</sup>) and high levels of fermentable sugars in the juice (total sugar 18-20 g L<sup>-1</sup> at the maturity peak), 2.0 t ha<sup>-1</sup> grain yield, and resistance to lodging and to major pathogens. Average maturity cycle for the production of ethanol is about 115-125 days after sowing, and with a period of industrial utilization (PUI) of more than 30 days.



Sugar profile of juice-extracted from stems of the sweet sorghum variety BRS 508

Trait	g L <sup>-1</sup>
Sucrose	142.60
Glucose	29.60
Fructose	7.41
Total reduced sugars	179.61
Brix (°B)	22.9

\* Values subject to variations according to climatic conditions, crop management and harvest period.

#### Exploitation Strategy

Sweet sorghum can be grown in all areas currently recommended for sugarcane production in Brazil. Sorghum can provide quality feedstock during the period between the months of February and April, before the beginning of sugarcane harvest for ethanol production, extending the total harvest period of distilleries for two additional months.

#### IPR Measures

The results of this project from Embrapa are freely available and the breeding materials developed and released herein are available for licensing by the private sector for seed production and commercialization. SWEETFUEL partners have had and continue to have access to both experimental and released cultivars with appropriate Material Transfer Agreements.

#### Further Research

This and other varieties (R-lines) will continue to be evaluated in an evaluation network as male parents of sweet sorghum hybrids as new sweet sorghum female lines (A and B lines) become available. Adaptation to other regions can be assessed through multi location and multi seasonal trials.

#### Impact of Exploitation

Research is currently underway to produce sweet sorghum during the period of sugarcane renovation (20% total area recommended annually) during the months of November to May to provide an alternative feedstock to anticipate sugarcane harvest and distillery operation by up to 60 or more days before the beginning of sugarcane harvest in April and May, increasing ethanol output and reducing ethanol production and operational costs.

## SWEETFUEL

Sweet Sorghum: an alternative energy crop



Contact for Exploitable Result:

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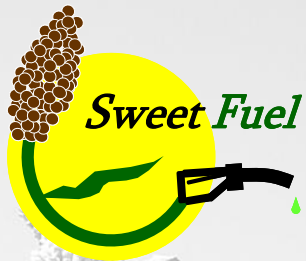


SWEETFUEL Website:  
[www.sweetfuel-project.eu](http://www.sweetfuel-project.eu)



SWEETFUEL is co-funded by the European Commission in the 7<sup>th</sup> Framework Programme (Project No. FP7-227422)

Results



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## Energy Sorghum

### An alternative energy crop

*A Handbook*



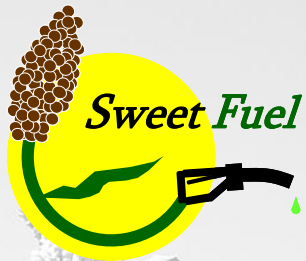
# FUEL

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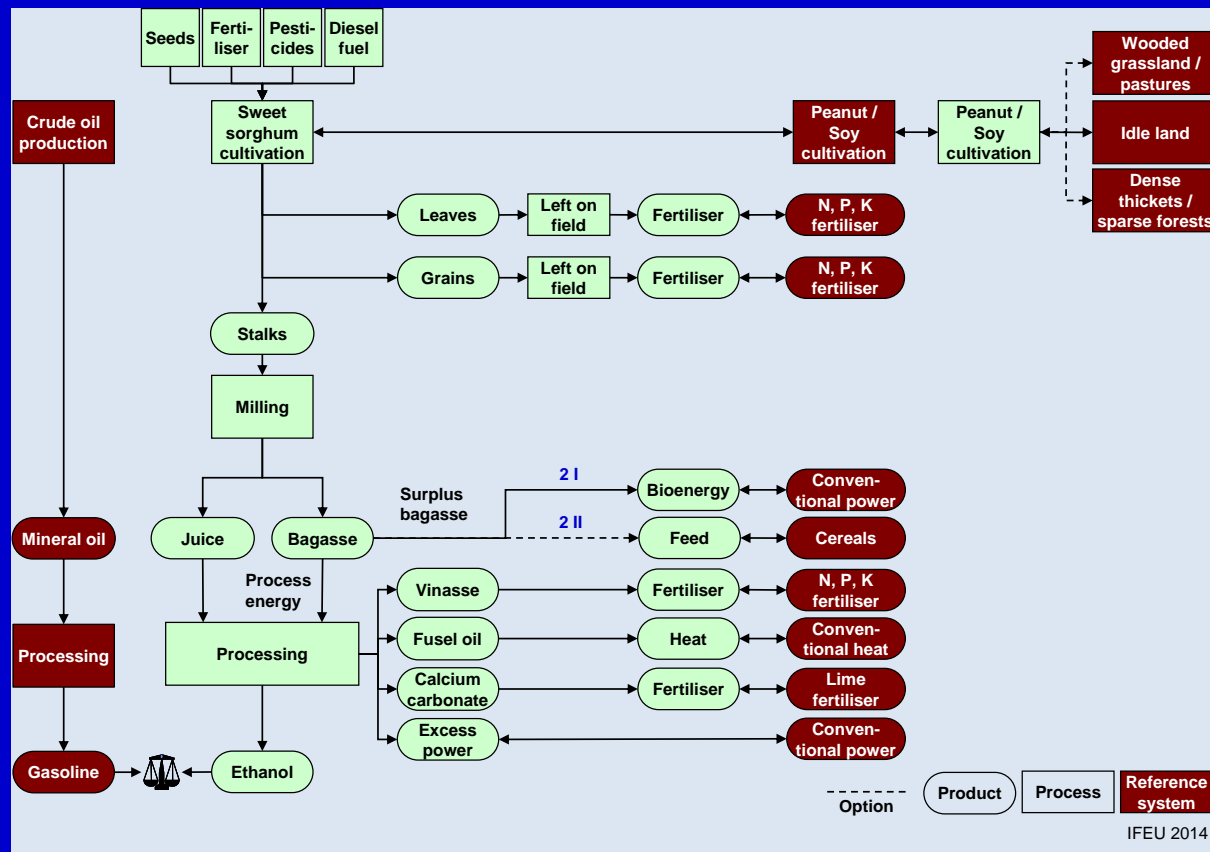
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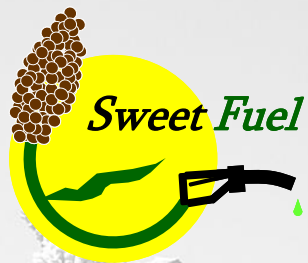


# Results of SWEETFUEL

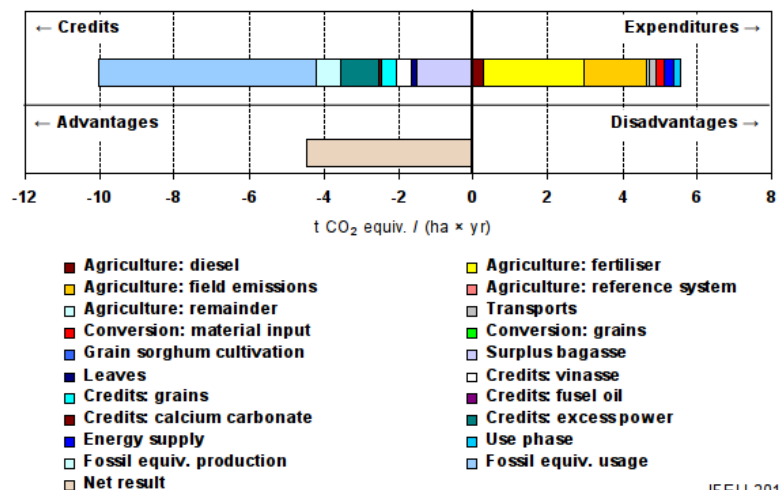
- Impact assessment / definition of the different scenarios



- for each scenarios and their options, an impact assessment was done at economic, social and environmental level, as well as a SWOT analysis, which results in various recommendations (see deliverables D6.2, D6.3, D6.4, D6.5 and D6.6)

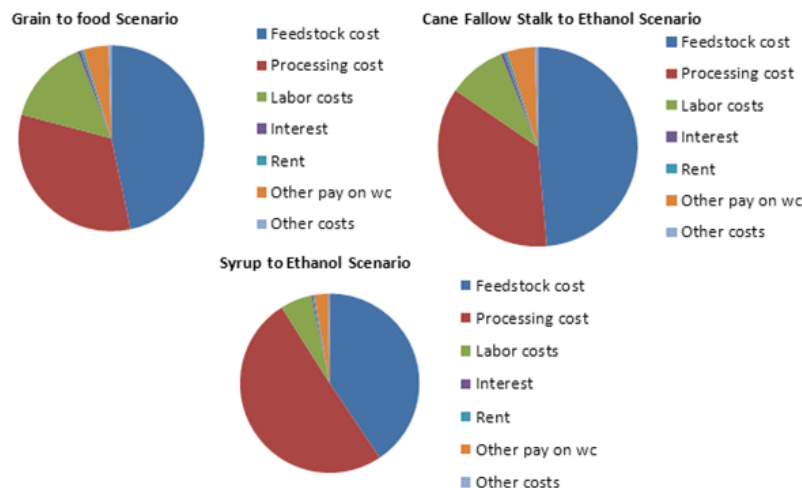


# Results of SWEETFUEL

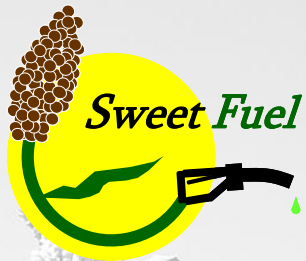


**Fig. 4-1** Contributions of individual life cycle steps (coloured sections) to the overall net result (light brown bar) of sweet sorghum ethanol production in the cane fallow scenario for the environmental impact category greenhouse effect. Results are based on typical cultivation and conversion conditions.

**Fig. 4-6** Breakup of operational costs for selected sweet sorghum scenarios, typical case



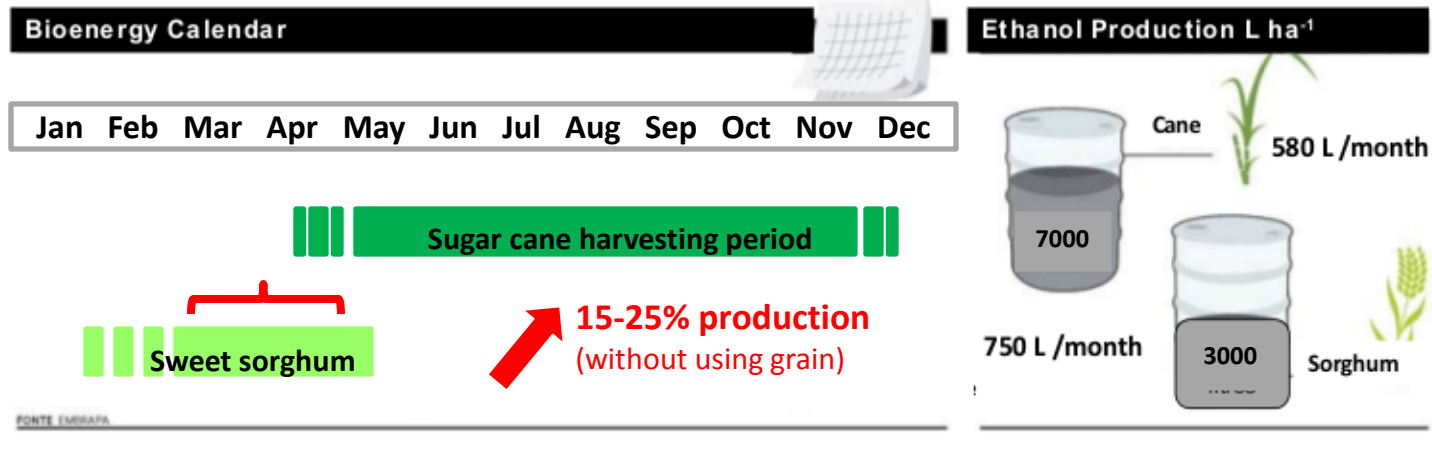




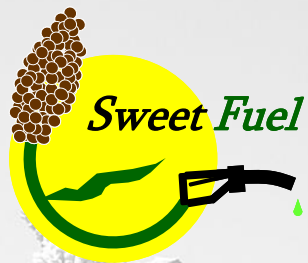
# Conclusions

- (sweet or biomass) sorghum is an efficient crop for producing energy (biogas, biomethane, bioethanol, heat), but...

Due to its seasonality, it must be combined with another crop



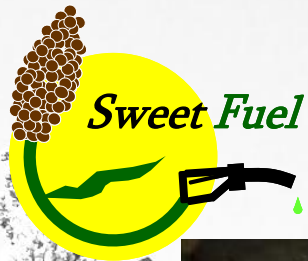
- Its efficiency, its impacts on environment (LCA, GHG balance, energy balance), depend on the biomass production and transformation processes, as well as the location of the production system



# Sorghum biomass has a promising future







Food

Feed

Fuel

Fertilizer

Fibers

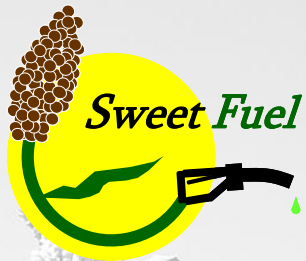
Bioproducts

...

Sweet sorghum:  
a multiple purpose crop











# *Thank you for your attention*

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(Web site: [www.sweetfuel-project.eu](http://www.sweetfuel-project.eu))

