FAPESP BIOENERGY PROGRAM BIOEN

http://bioenfapesp.org

One of the most productive cultivated plants - a large biomass

Commercial sugarcane is vegetatively propagated through stem cuttings

In 12 months the plant will reach 4-5 meters with the extractable culm measuring 2-3 meters

After harvest, underground buds will sprout giving rise to a new crop (6 harvests)

C4 carbohydrate metabolism - large amount of carbon partitioned into sucrose (up to 42% of the stalk dry weight, around 0.7 M in mature internodes)

488 million tons of crushed stems (Brazil 2007/2008)
51.1% etanol
48.9% sugar
Up to 90% of the bagasse used for energy co-generation

SUCEST EST Sequencing Project

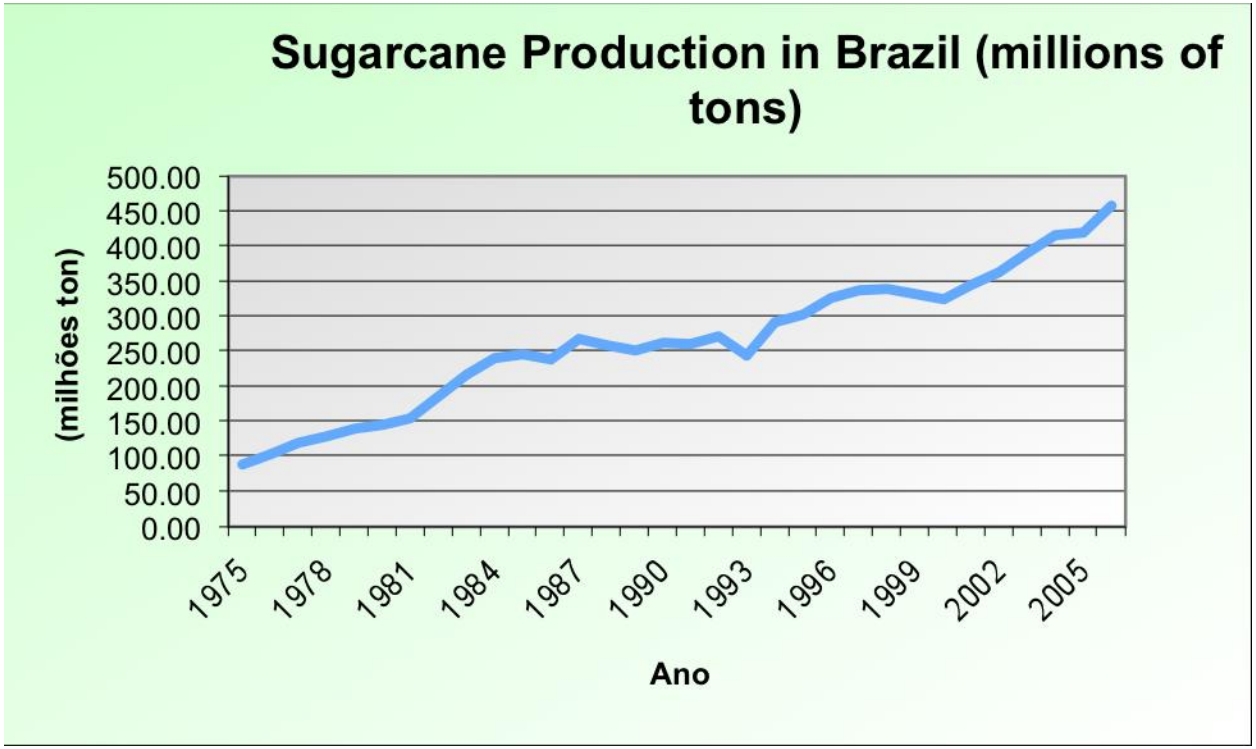
Breeding Programs

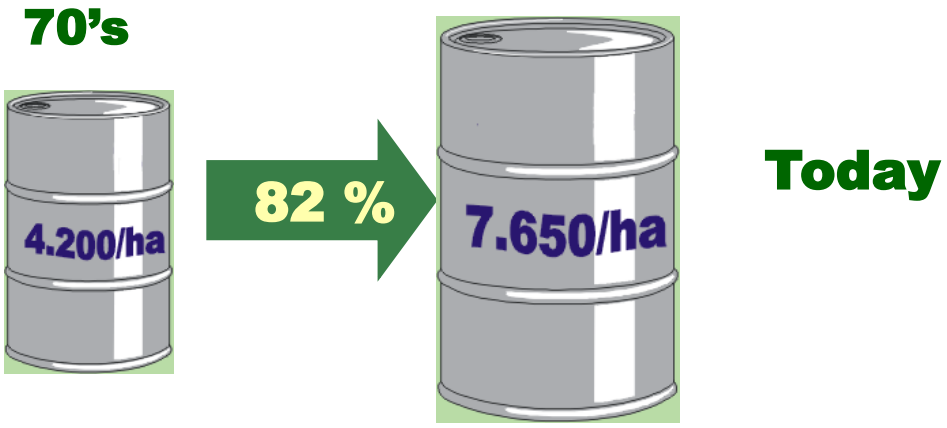
Biotech Business

Sugarcane Genome Sequencing Initiative

FAPESP Bioenergy Program BIOEN

Increased Yield





PROCESSING DIVISION

Engineering, processing and equipment design aspects of bioethanol production
Cellulosic Ethanol

Increasing productivity (amount of ethanol by sugarcane ton), energy saving, water saving and minimizing environmental impacts

Advances are expected in technology for:

sugarcane reception
juice extraction
hydrolysis processes
fermentation
distillation
waste recycling and disposal
co-generation
alternative industrial processes development

On cellulosic ethanol:
Characterization and development of physical, chemical pretreatment of bagasse for ligninocellulose hydrolysis
Development of acid catalyzed and biocatalyzed saccharification
Development of high performance cellulases and hydrolases
Removal of fermentation inhibitors
Pentoses and hexoses efficient fermentation processes
Development of microorganism strains
Effluent disposal and environmental friendly accepted processes

ENGINES DIVISION

Research to consolidate ethanol as the renewable substitute for gasoline on a short to medium term (10 to 20 years), with the evolution of internal combustion engines, and on a long term with fuel cells.

Flex-fuel engines with the same performance, consumption, pollutant emissions and durability as the engines would run on a particular fuel blend

Adjust the engine compression ratio
Solve the cold-starting problem when using only ethanol
Understand the role of ethanol in new engine configurations (direct fuel injection together with port injection and turbo-chargers to decrease fuel consumption and CO_2 emission)
Study compatibility with after-treatment devices used for emissions control
Develop ethanol or sugarcane products with physical-chemical properties adequate for compression ignition engines

BIOREFINERIES DIVISION

Industrial units near sugar and alcohol industrial facilities that take advantage of renewable raw materials available (ethanol, sugar, CO_2, bagasse, trash, yeasts) to produce high added value products

Sugarchemistry for intermediate chemical production
Alcoholchemistry as a petrochemistry substitute

Partial oxidation of carbohydrates
Chemical synthesis of intermediate oxygenated chemicals (alcohols, acid ketones), polymers (PHA, lactic acid), nutraceuticals directly from sucrose
Biocatalysis for transformations of carbohydrates in valuable chemicals

Products from ethanol via acetaldehyde and ethylene route produced much easily than from oil (now economic)

Consorted ethanol-biodiesel production with oleaginous in the sugarcane reform area

Complete substitution of fossil fuel derived compounds

IMPACTS DIVISION

Horizontal themes: Social and Economic Impacts, Environmental studies and Land Use

Ethanol as a global strategic fuel

New technologies

Increase of sugar cane planted area

→ Fast growing rates of production →

Effects on environment, on social relations and other economic activities →

Risk assessment
Carbon and energy balances
Greenhouse gases emissions gain
Competition with food supply, energy supply and local materials

Studies to consolidate sugarcane ethanol as the leading technology path to ethanol and derivatives production

Certification methodology: Sustainability

BIOMASS DIVISION

Identify new paths to genetically manipulate the energy metabolism of cultivated plants, creating new biofuel alternatives

- Genome sequencing
- Comparative, structural and evolutionary genomics of grasses
- Development of new sugar cane cultivars
- Biochemical, physiological and agronomic evaluation of cultivars
- Discovery of genes associated with agronomic characteristics of interest
- Analysis of transcriptome, proteome and metabolome
- Signaling, regulation of gene expression and regulatory networks
- Genetic transformation of sugar cane and other grasses
- Molecular markers
- Physical, genetic and molecular mapping of genomes
- Metabolic networks of the production of carbohydrates and sucrose
- Cell wall structure and function, cellulolytic fungi
- Bioinformatics
- Impact of climate changes, sustainability and productivity
- Environmental impact of GM sugar cane and biosafety

Contribute with knowledge and technologies for Sugarcane Improvement
Enable a Systems Biology approach for Biofuel Crops

BIOTECHNOLOGICAL ROADMAP FOR THE IMPROVEMENT OF SUGARCANE

Join Academia, Biotech Companies, Breeders for a discussion on the challenges and routes of sugarcane improvement

How should we design the Sugarcane of the Future?

Issues on Genomics, Transgenics, Physiology and Breeding research

Format:
25-30 min talks followed by 30 min Debate

Each Debater has 5 min to expose his points and question the speakers

The Discussion will be then opened to the general audience

A team of students and post-docs will consolidate the Conclusions on a White Paper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