



**African Caribbean and Pacific Group  
of States (ACP)  
*Science and Technology Programme***

**Biofuels Production vs. Food  
Security**

*Joe Asamoah, Ph.D*

Yiri Lodge, University of Ghana 2 – 4 April 2013

# Outline

- **Global Biofuel (BF) Production**
- **Threat to Africa by Biofuel Production**
- **Statistics on BF Production**
- **Potential of Cellulosic BF**
- **Ligno-Cellulosic BF Production –  
Enzymes**
- **Bio-Ethanol**
- **Generations of BFs**
- **Conclusion**

# Global Biofuel (BF) Production 1



**Trebled from  
2000 - 2007**



**Expected to 2ble  
again by 2011**



**Interest as  
alternative to  
fossils use in  
Transport**

# Global BF Production 2



- More production due to enforcement of Kyoto Protocol – 2005
- Pursuit of BF Targets in African countries
- More attention to BFs production by policy makers and researchers

## *Outcomes*

- Energy Security vs. food security
- Shift of BF from multipurpose solution to climate change, food insecurity and underdevelopment to “crime against humanity” (by UN Special Rapporteur)



# African Threat by BF Production

- Food Security - Major Challenge
- Food vs Fuel Debate
- Land Ownership and Livelihoods

# **Statistics on BF Plantations in Africa 1 – British Firms**

- British firms acquired more land in Africa for BF plantations than companies from any other country**
- 50% of 3.2m ha. of BF land identified from Mozambique to Senegal, linked to 11 British companies**

# Statistics on BF Plantations in Africa 2

- **Liquid fuels made from plants – e.g. bioethanol – environmentally-friendly replacements for fossil fuels.**
- **Due to competition for land with crop plants, BF have (in some cases) led to**
  - record food prices and**
  - rising hunger**
- **They can increase GHG emissions.**

# Statistics on BF Plantations in Africa 3



- **Sub-Saharan Africa – 100 projects and 50 companies in over 20 countries.**
- **Crest Global Green Energy (CGGE) has largest recorded landholding, 900,000ha in**
  - ❑ **Mali,**
  - ❑ **Guinea &**
  - ❑ **Senegal.**
- **Tom Stuart, CEO said: "It is true in some cases biofuels displace food, but in our projects we 'inter-crop', planting with food on the marginal.**



# **Statistics on BF Plantations in Africa 4**

- There is social element to CGGE projects, with all the local people put into the agreements**
- Sun Biofuels (UK) leased 8,000ha in Tanzania where it grows *Jatropha curcas***

# Jatropha Plantation



**An Ivory Coast nursery for jatropha, a non-edible plant whose oil-rich seeds can be processed into biodiesel.  
Courtesy Kambou Sia/AFP/Getty Images**

# Cellulosic BFs Potential 1



**Second-generation biofuels from ligno-cellulosic biomass, like:**

- forestry and crop residues,**
- corn stover, and**
- switchgrass) are regarded as preferred feedstock for BF due to**
- vast abundance of biomass crops**

# Cellulosic BFs Potential 2



## Current cellulosic biomass-to-BF

- conversion processes still under development, & large-scale harvesting, storage, and
- Refinery systems not yet cost-effective
- Companies operate pilot-scale facilities &
- Will develop small commercial-scale bio-refineries for wood chips, prairie grasses, and crop residues

**within two to three years.**

# Cellulosic BFs Potential 3

- Cellulosic biomass is composed of sugar polymers that can be broken down & fermented to ethanol,
- Because it provides the structural rigidity for plants and trees,
- It has evolved to be highly resistant to degradation from predatory organisms.

# Enzymes for ligno-cellulose degradation



**Enzymes being**

- **Developed for ligno-cellulose degradation, but**
- **Conversion efficiency limited, & their**
- **Cost too high for large-scale commercialization.**

# Bio-ethanol



- **Bio-ethanol is most widely used BF and is substituted or blended with gasoline.**
- **Produced by fermentation from**
  - sugarcane,**
  - maize,**
  - cassava,**
  - wheat,**
  - sugar beet, and**
  - sweet sorghum**

# Bioethanol Production



**As of 2005, leading bio-ethanol producing countries include:**

- Brazil (16.5 giga-liters per year),**
- US (16.2),**
- China (2.0),**
- European Union (1.0), &**
- India (0.3).**



# Summary of Biofuel Generations

First Generation	Second Generation	Third Generation	Fourth Generation
Biofuels produced from food crop	Biofuels produced from non-food crop	Genetically modified carbon neutral crop	Genetically modified carbon negative crop

# Fourth Generation Biofuels

More carbon is  
consumed than  
released during  
use

# Why the Plethora of Generations?

- **Challenge - food versus fuel**
- **Climate Change concerns**
  - Carbon Intensity**
  - Carbon neutral**
  - Carbon negative**

# Designed Biofuels

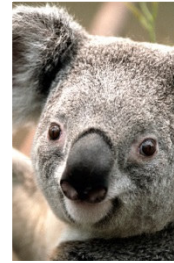


- Genetically Modified
- Use of Microbes

# Positives of 4th Generation Biofuels



**Non- Food**



**Carbon -  
Negative**



**Good in  
Sequestration of  
CO<sub>2</sub>**

# Conclusion

- **In Africa Biofuels (crop types) may pose a threat**
- **Cellulosic BFs have potential**
- **Plethora of BF Generations to address Food Security Issue**
- **Fourth Generation, for now has overcome challenges**

THE END

