Biochar and Food, Water and Energy NEXUS

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OUTLINE

- Problem Highlight
- The History
- Biochar technology
- Biochar technology performance and uses- Energy ..
- Biochar and Food; Biochar/biofertilizer nutrient and water NEXUS
- International recognition

Problem?

Situation

- Land degradation and poor soil fertility due to deforestation and climate change;
- Drought /Irregular rainfall/Poor or no harvest;

Challenge

- Food insecurity;
- Inefficient Energy Access;

Effect

- Climate change related poverty;
- Migration.

THE HISTORY

- The ELSA (biochar) burner was developed for Africa through scientific cooperation between ASA Initiative, ECREEE, Starter and European/African Universities under EU/ACP S&T Programme

BeBi Project

EU/ACP S&T
Programme l

BIOCHAR PLUS
EU/ACP S&T
Programme ll

BIOCHAR TECHNOLOGY

- Slow pyrolysis, low-temperature plant/ cooking stove
- **Uses biomass -agro and agro-industrial residues/waste for pellet as fuel; and**
- **raw biomass such as empty palm bunches, various types of nuts shells and corn cobs etc.**

- Pyrolysis process, syngas released from feedstock, is burnt cleanly with negligible emissions of CO_2, CO, NO_x and PM, = improving indoor/outdoor air quality over wood & charcoal stoves.

Pelletizing or fuel processing

Turning Waste into Fuel

Corn cob -Agrowaste

Pellets for cooking = more efficient burning time

Biochar burner-One aspect of the Technology

Efficient quality biochar

- Produces heat for cooking and releases by-product- **Biochar**

Biochar from Biomass

Performance of Technology

Energy - Performance

- 0.6-1.5kg of fuel produced energy for cooking for 1-2hrs depending on fuel quality and air conditions with fire power of 2.7kw;
- Used to cook for 2-12 household members.
- Up to an hour for industrial cooking with solid biomass;
- High thermal efficiency 20 - 25%

Biochar-Output and quality

- **100% of biomass input results into 25-30% biochar;**
- **High level biochar ;**

ELSA BIOCHAR TECHNOLOGY-USES

- The energy produced is **Green**; carbon stored in the biomass (70%-90%) converted to gas (10% to30%) turned to black char (biochar)
- It could be used for cooking & produce biochar simultaneously **or** to produce only biochar **or**
- converted to generate bio-electricity .

1. Domestic use=Household cooking

2. Industrial use =Oil processing etc

Effect of Energy access:

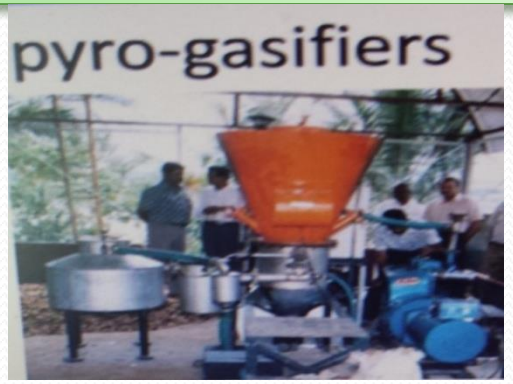
- by 17,576 resident families would cause a decrease in deforestation rates of 0.12% $year^{-1}$(=25,530 t of wood $year^{-1}$) with fuel substitution of waste coffee husk, corn cob etc

Capable of producing fire power of 187,068 MJ $year^{-1}$

- Carbon stored in fuel (biomas) =1/2 is converted to gas and 1/2 remains in the created char. ***(Source: adapted from Wilson (2013), based on Biochar Solutions Inc. (2011) , printed in Roth (2014)***

Large plant Pyro-Gasifiers

100% Biomas as input



- Large Plant for factory/off grid power
- 90% of Biomass converted to

Bioelectricity Production/Off grid energy access

Biomass source or a central point where biomass can be easily accessed.

Biofertilizer for application to farm land

Biofertilizer for Soil Amendment

- Biochar/Biofertilizer




- Biochar fields



Output of Maize farm with Biochar Treatment

- **Resistant to drought;**
- **Resistant to army worm infections.**

- Healthy and sturdy growth;
- Maize on every part of the cob.
- More biomass generated.

Double Output

Maize from Non Biochar treated farm

Maize Farm with no biochar =Same maize variety =less biomass

Maize Output with no biochar treatment

...continue- Biochar/Biofertilizer

- **Biochar** helped produce healthy food by preventing the crop from absorbing toxic elements like weedicide and other heavy metals from mining activities;
- **Improved weed management; (soft weeds)**
- **Biochar** facilitated water and nutrients retention of the crop land over long period and make it available to the plants;.

- Application of bioferilizer changed the soil structure by improving soil fertility;

Biochar prevents certain soil and plant diseases

Biochar prevents army worm diseases

Biofertilizer removes soil born diseases such as Nematodes

Biochar and water retention

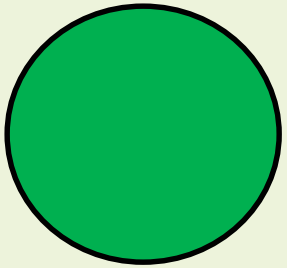
No biochar treatment
Manure treatment

Biofertilizer treated soil

Two farms with the same boundary, Pawpaw variety, planting time. Biochar retains water and nutrient over long period of time and make it available to the plant.

INTERNATIONAL RECOGNITION

- Evaluated (Dec 2016) by FAO-Rome as the best IFES for Africa



Thank You

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