

POWER | FOOD | CLIMATE

# Gasifier and Biochar

## Applications in Kenya - How to Expand Further



**Biochar Production Surveys**

Map: [View Map](#) | [Download Map](#) | [Print Map](#)

User	Location	Date	Quality Type
Evans Kariuki	Wajir, Kenya	2023-01-15	High
Evans Kariuki	Wajir, Kenya	2023-01-15	Medium
Evans Kariuki	Wajir, Kenya	2023-01-15	Low

**Details**

**Survey ID:** 1234567890  
**Location:** Wajir, Kenya  
**Quality Type:** High  
**Collected Date:** 2023-01-15 10:00:00

**Images:**

- Tag: Biochar production equipment code  
Collected Time: 2023-01-15 10:00:00  
Distance from survey: 1.00 m  
Coordinates: 123456, 7890123456
- Tag: Biochar production action form  
Collected Time: 2023-01-15 10:00:00  
Distance from survey: 1.00 m  
Coordinates: 1234567890, 9012345678





▷ **CIRCULAR**  
▷ **INCLUSIVE**  
▷ **EMPOWERING**

- 01** Sourcing & processing feedstock
- 02** Pyrolytic conversion (captive heat & power)
- 03** Cascaded recycling on & off the farm
- 04** Crop & soil specific recommendations
- 05** Full accounting of soil C balance change



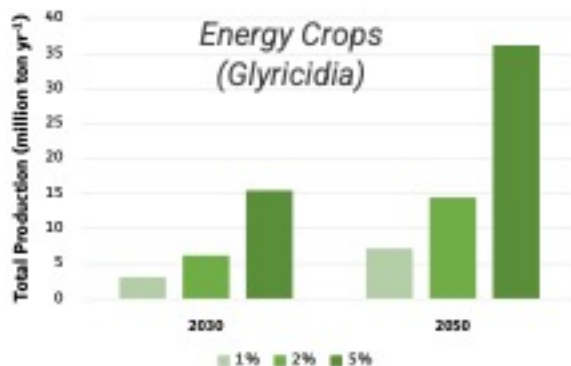
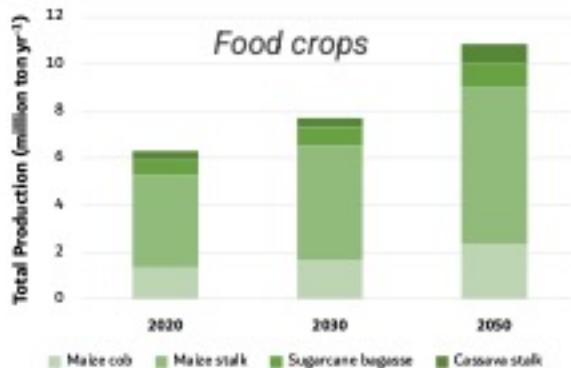
# RENEWABLE BIOMASS

## Sourcing & Processing of Feedstock

- Quantifying total and removable biomass residues

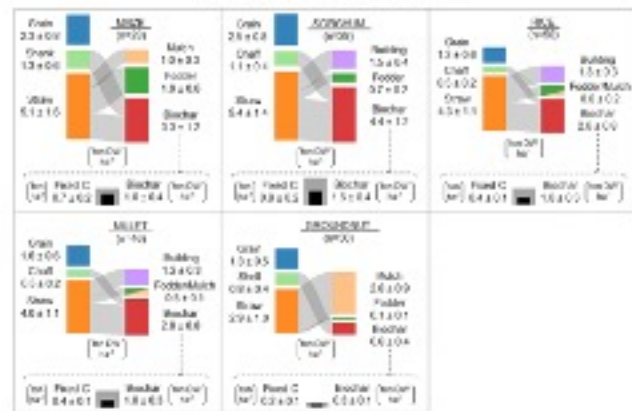
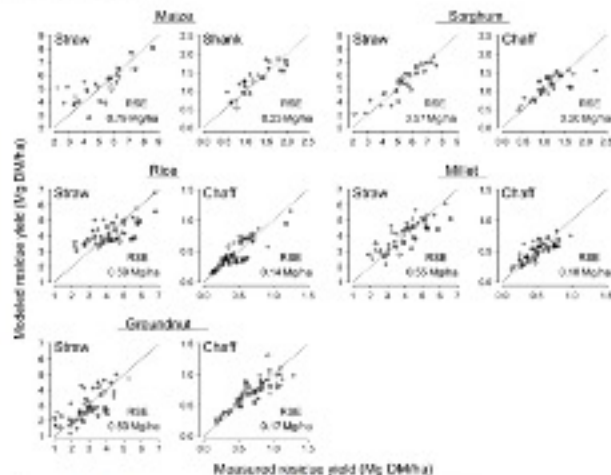
Kenya biomass potential

From: Welfle et al. 2020, <https://doi.org/10.1016/j.biombioe.2020.105757>



Allometric prediction & Scenario analysis

From: Roobroeck et al. 2019, <https://doi.org/10.1002/eap.1984>





# RENEWABLE BIOMASS

## Sourcing & Processing of Feedstock

- Identify suitable biomass residues for feedstock supply and gasifier system



1-month-old pruned



1-year-old pruned

*Grade 1 & 2 tea pruning*



*Grade 3 & 4 tea pruning*



*Murubai invasive tree*



*Miscanthus stalk*



*Maize shank*





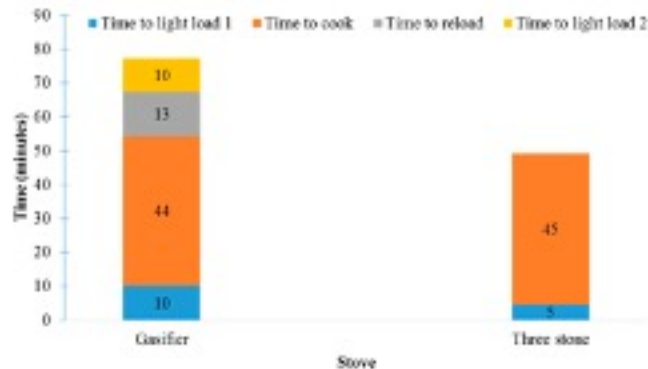
# BIOMASS GASIFICATION

## Pyrolytic Conversion System (domestic)

- Match technology with cooking and agricultural practice
- Operational costs and feedstock supply



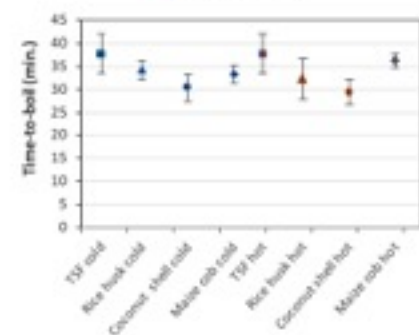
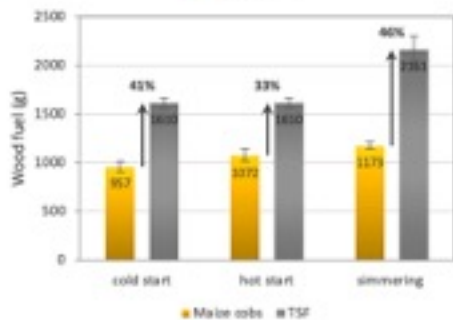
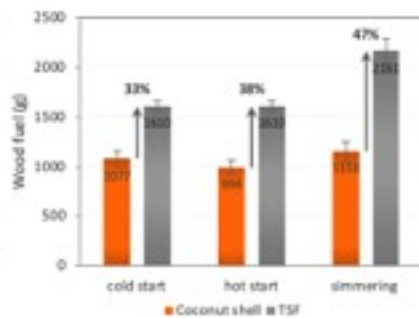
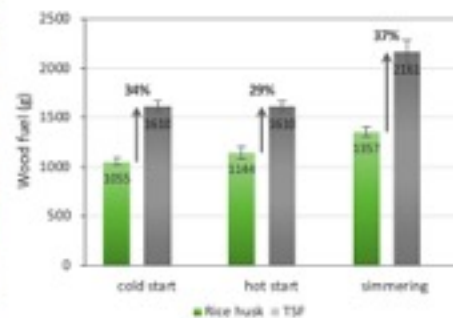
From: Gitau et al.  
2019,  
<https://doi.org/10.3390/en12224285>



Stove



From: Zabrian et al. 2023, Submitted





# RENEWABLE BIOMASS

## Sourcing & Processing of Feedstock

- Establish operating procedures and labour intensity/costs for collection
- List risks and optimization needs for collection and processing chain



*Collection, sorting and transfer*



*Chipping and storage*

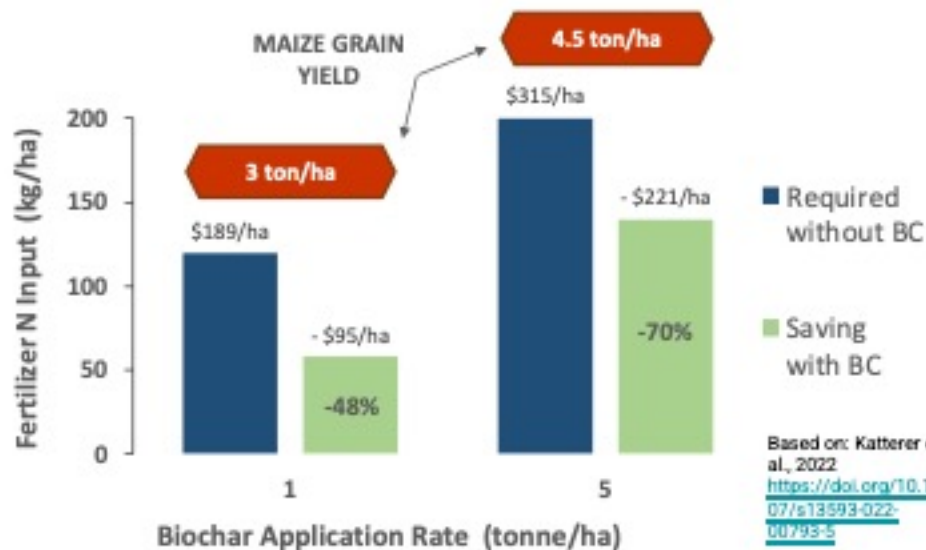




# SUSTAINABLE AGRICULTURE

## Crop & Soil Specific Recommendations

- Formulate agronomic advisory for different food/cash production systems in line with accompanying inputs



Linear yield equivalence models show that applying biochar at 1 and 5 ton ha<sup>-1</sup> the farmer would reduce N input by 48% and 70% while maintaining the same production level.





# BIOCHAR PRODUCTS

## Cascading Utilization of Biochar Products

- Life-cycle augmentation through loops for improved nutrient management and material substitution

### ON-FARM



Manure + Biochar



Compost + Biochar

**REDUCES**

Greenhouse gas emissions  
Nutrient leaching to groundwater  
Pest and disease proliferation

### COMMERCIAL



- Coating of urea fertilizer for storage
- Slow-release agent for chemicals
- Chardboard industrial packaging
- Durable soil cover to replace plastic
- Media for vegetable, banana and tree nurseries





# Pyrolytic Conversion System (industrial)

- Match technology with municipal and factory needs
- Equipment cost and business investment plan



20-30  
kWe



0.5  
MWe

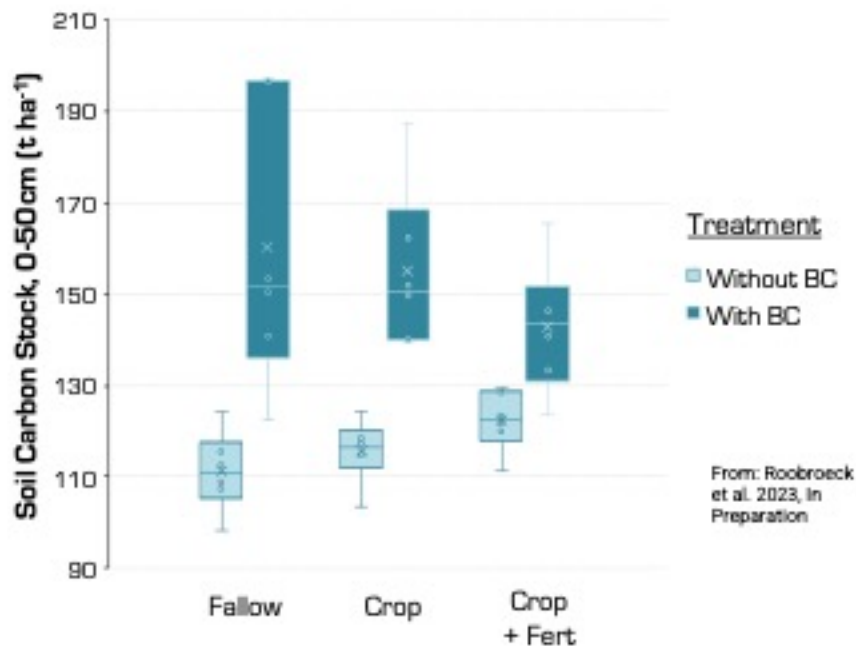


Dryer



## Full Accounting of Soil C Balance Change

- Biochar amendment persistently increases soil C stock under intensive cropping
- Fertilizer addition enhances plant C input but reduces soil C gain of biochar
- Standards for C sequestration must consider gains from biochar and plant inputs linked to farming practices



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# Questions & Answers



The screenshot displays a web application interface for 'Biochar Production Surveys'. It includes a search bar, a table of survey data, and a details panel. The table lists survey entries with columns for User, Location, Date, and Quality Type. The details panel shows information for a specific survey, including a map, a list of images, and metadata such as 'Tag', 'Collected Time', 'Distance from survey', and 'Coordinates'.

User	Location	Date	Quality Type
Evanyra Helena WafukuKanya, Bungoma		January 19th 2023, 10:25:05 +03:00	unsorted
Evanyra Helena WafukuKanya, Bungoma		January 19th 2023, 10:26:05 +03:00	unsorted
Evanyra Helena WafukuKanya, Bungoma		January 19th 2023, 10:27:05 +03:00	unsorted

**Details**

**Tag:** Biochar production equipment code  
**Collected Time:** January 19th 2023, 10:25:05 +03:00  
**Distance from survey:** 1.00 m  
**Coordinates:** 0°04'55.14 S, 34°54'00.0000000000 E

**Images:**

- Tag Biochar production equipment code
- Tag Biochar production active burn

