



B a n g l a d e s h
B i o c h a r
I n i t i a t i v e



Household Acceptance of the 'Akha' TLUD Cookstove and Biochar in Bangladesh

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Expanded version with added photographs

kerk
in actie

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INTRODUCTION: THE NEED FOR A COOKSTOVE-BIOCHAR ECOSYSTEM

The Challenge

Initial Objective 2013

- Urgent need for **biochar** to **increase soil productivity**
- to compensate for **loss of land** from rising sea levels, and
- **extreme weather** caused by climate change.

Problem

- Bangladesh has only 17% forest cover.

Solution

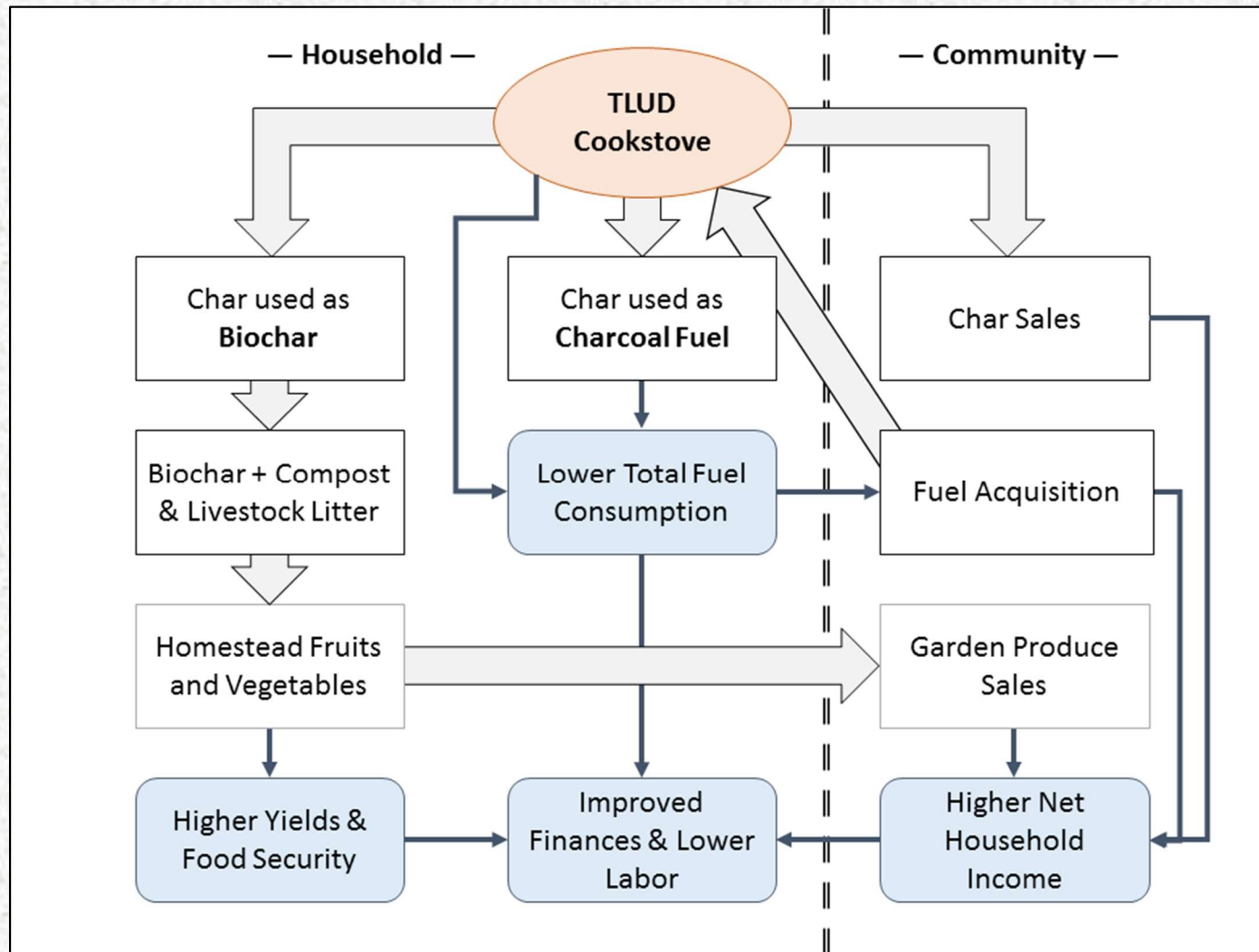
- Top-Lit Updraft (TLUD) semi gasifier cookstoves make biochar as a by-product of cooking.

New Objective: Create Village TLUD — Biochar Ecosystems

- Create a culturally adapted TLUD.
- Demonstrate the utility of biochar for growing food and livelihoods.
- Create a feed-back demand for TLUDs.

The TLUD-Biochar Ecosystem

The TLUD Stove is the Ecosystem's Keystone Component



A Culturally Adapted Stove



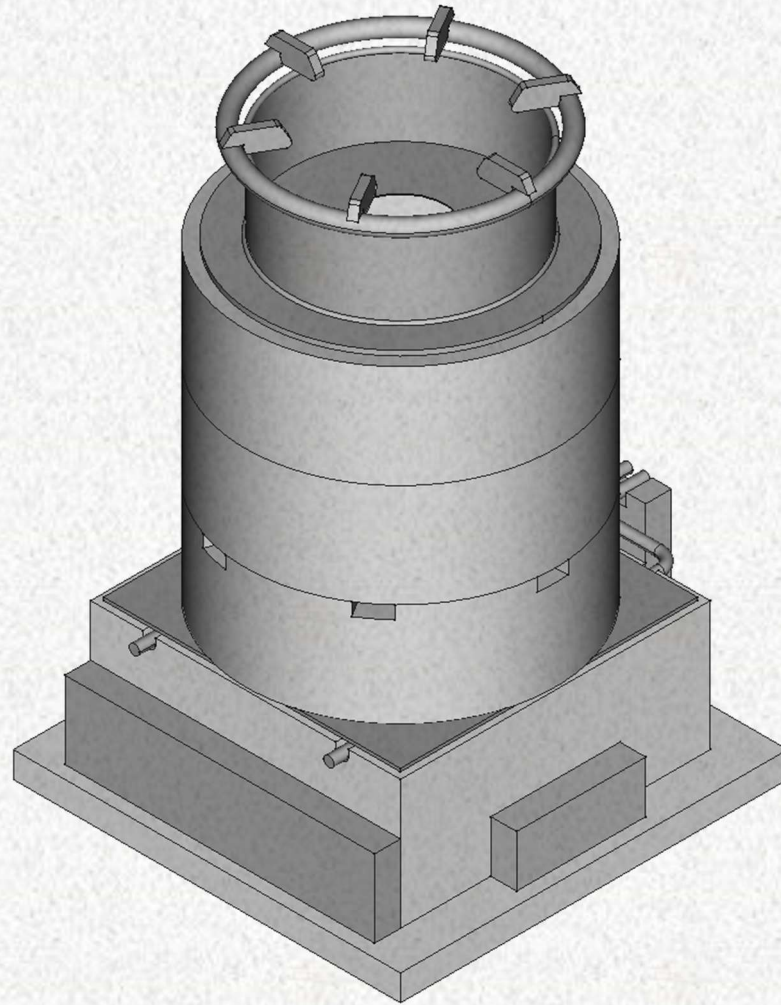
Sturdy cooking platform
Low radiant heat
Low risk of burns
Hard to steal
Easy to collect char
Easy to repair
Burns wood chunks

Easily copied and
Manufactured regionally

***THE AKHA CHULA – AGRICULTURE-
FRIENDLY STOVE***

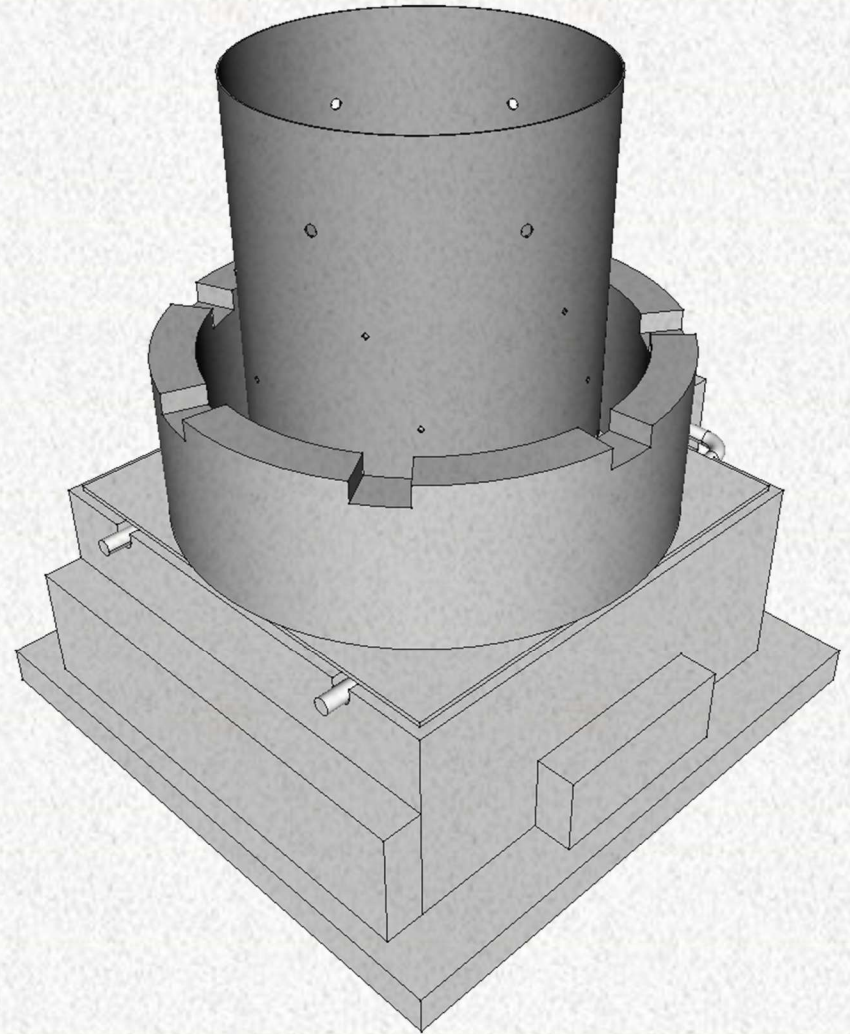
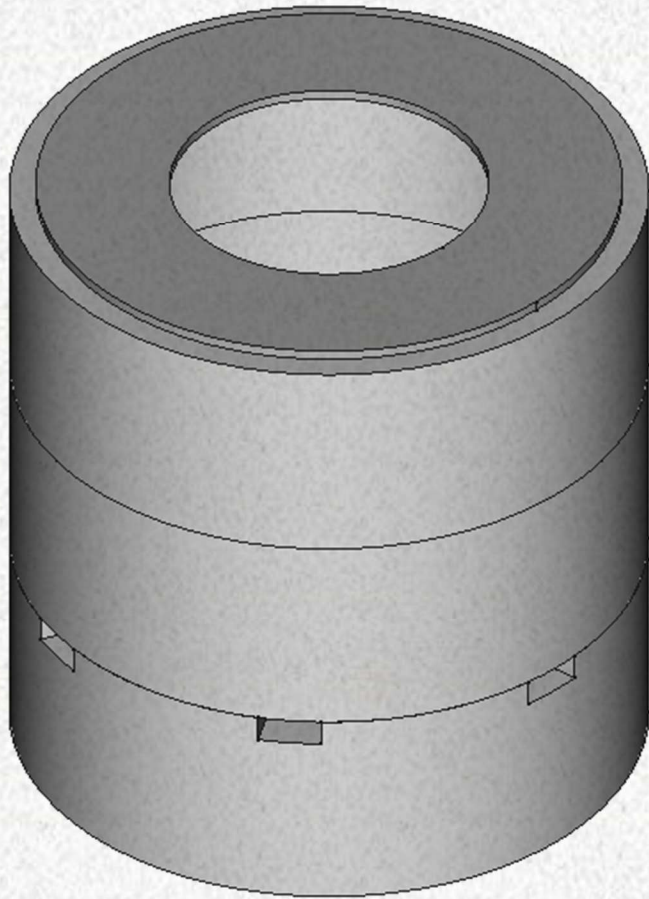
The 'Akha Chula – Agriculture-Friendly Cookstove'

Natural Draft,
Top-Lit Updraft
Semi-Gasifier
Cookstove
(ND-TLUD)

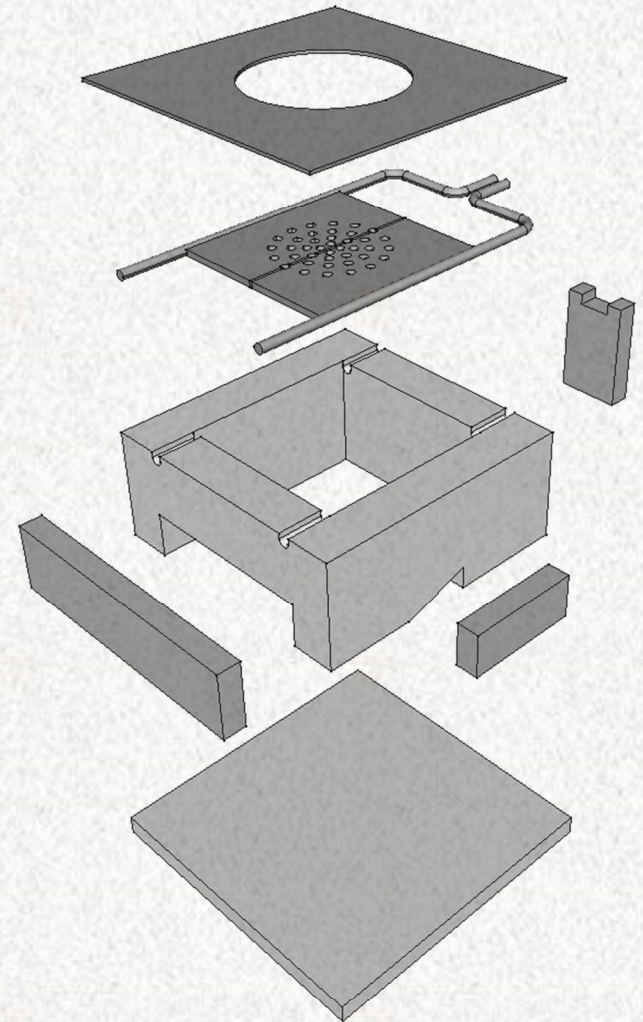
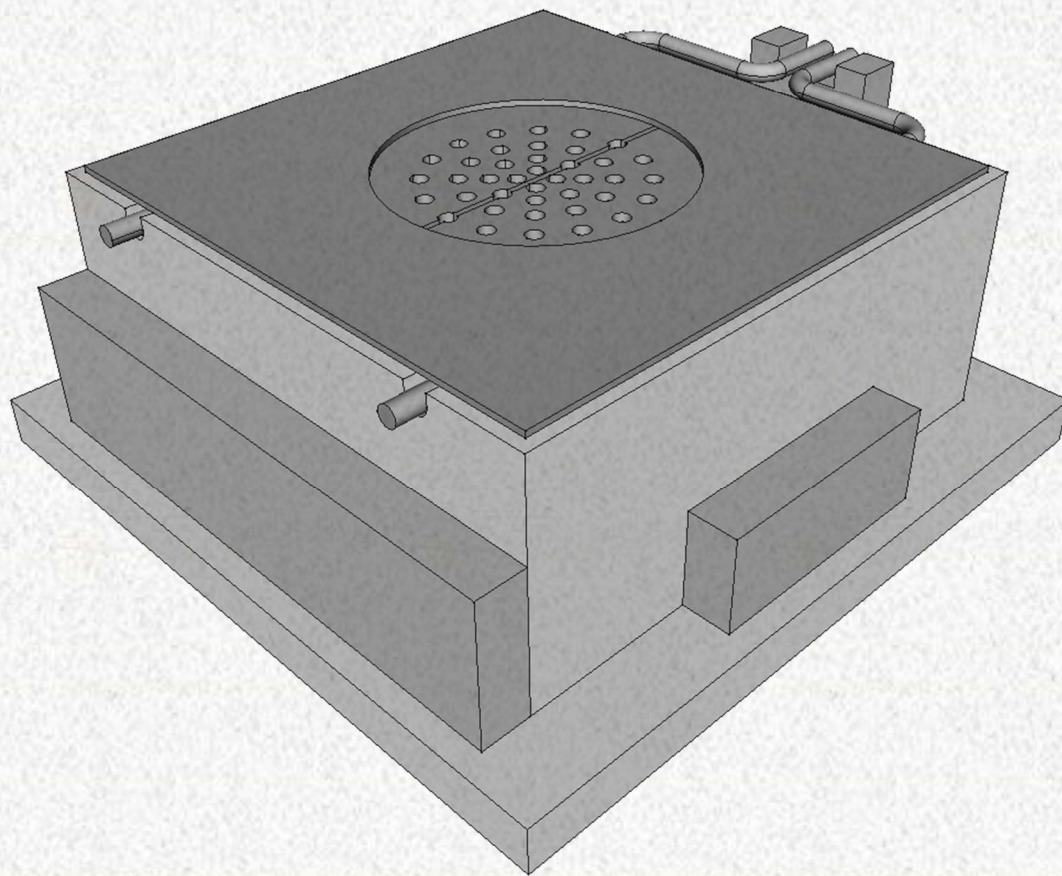


Concentrator
Ring Burner
modelled on
Champion
and *Peko-Pe*
Stoves

Distinction 1: a concrete outer stove body



Distinction 2: a hinged grate,
Distinction 3: on a concrete base
Distinction 4: for char removal



The *Akha* Can be Made by Small Enterprises



Locations of *Akha*-Biochar Trials

| | Shibalaya | Manda | Daudpur |
|------------------------------------|------------|------------|-------------------|
| ExPoverty | 7%-15% † | 6% or less | 16%-24% |
| Flooding | Annual | Infreq. | None |
| Drought | Infreq. | Common | Common |
| City | Very Close | Close | Distant |
| Soil Fertil. | Good | Good | Low |
| Crops/yr | 2 | 3 | 2 |
| <i>Akha</i> TLUD – Biochar Project | | | |
| | Shibalaya | Manda | Daudpur |
| Ethnicity | Bengali | Bengali | Shantal, Oraon |
| <i>Akhas</i> | 37 | 28 | 46 |



† Bangladesh Bureau Statistics, HIES, 2010

BIOCHAR USERS GROUPS (BUG)

BUG Training: *Akha* Assembly

Jannatul Ferdous (in pink) demonstrating *Akha* assembly and repair



BUG Training: Performance Trial

Stove Operation

*Akha vs. a
Traditional
Stove*



*Akha cooks
faster, and
uses 25%
less fuel*

BUG Graduation Day

Participants take home an Akha for personal use and evaluation.



Akhas in the Home

Milita Mardi-Fazilpur, Pinky Rani Halder and China Halder



(a) Daudpur, (b,c) Shibalaya

Akhas in the Home

Runa uses her Akha as a Drier for her Baby's Cloths



Kamar kuri Village, Manda

Akhas in the Home

Shamoly and Kobita Compare an Akha with their '*Bhondu Chula*' Chimney Stove



Ethnic Shantal People, Daudpur

HOUSEHOLD EVALUATION OF THE AKHA — THE INITIAL IMPRESSIONS

Almost all Households Used a Traditional Cookstove



Compared to a traditional stove, does it take more or less time to prepare wood fuel?

| Answers | Location | | |
|------------------------------------|--------------------------|---------------------------|---------------------------|
| | Shibalaya | Manda | Daudpur |
| Fuel for the <i>Akha</i> takes ... | — (%) — | | |
| (-2) Much Longer | 3 | 4 | 9 |
| (-1) Longer | 81 | 52 | 20 |
| (0) Similar | 16 | 17 | 52 |
| (1) Faster | | 26 | 20 |
| (2) Much Faster | | | |
| Mean Answer (between -2, 2) | Longer (-0.86) | Similar (-0.35) | Similar (-0.17) |

Functional Performance Index of the Akha

| Compared to a cooking with wood on a traditional stove, do you find that the <i>Akha</i> ... | Location | | |
|--|--------------------------------------|------------------------|----------------------|
| | Shibalaya | Manda | Daudpur |
| | — (mean answer between 0 and 4 †) — | | |
| ... uses less fuel? | Mostly (3.97) | Mostly (4.00) | Mostly (3.83) |
| ... cooks food faster? | Mostly (3.97) | Mostly (3.87) | Mostly (3.65) |
| ... produces less smoke? | Mostly (3.67) | Mostly (3.35) | Mostly (3.43) |
| ... is easier to light? | Mostly (3.83) | Mostly (3.70) | Often (2.96) |
| ... goes out unexpectedly? | Sometime (1.81) | Sometime (1.87) | Rarely (1.09) |
| ... is easier to turn down heat? | Mostly (3.86) | Mostly (4.00) | Mostly (3.74) |
| ... keeps pots cleaner? | Mostly (3.97) | Often (3.43) | Mostly (3.85) |
| ... is easier to stop (put out)? | Mostly (3.94) | Mostly (4.00) | Often (3.22) |
| ... is easier removing ash /char? | Mostly (3.81) | Mostly (4.00) | Mostly (3.93) |
| ... requires less attention allowing other tasks? | Mostly (3.97) | Mostly (3.70) | Mostly (3.87) |

† Answers: (0) Never, (1) Rarely, (2) Sometimes, (3) Often, (4) Mostly

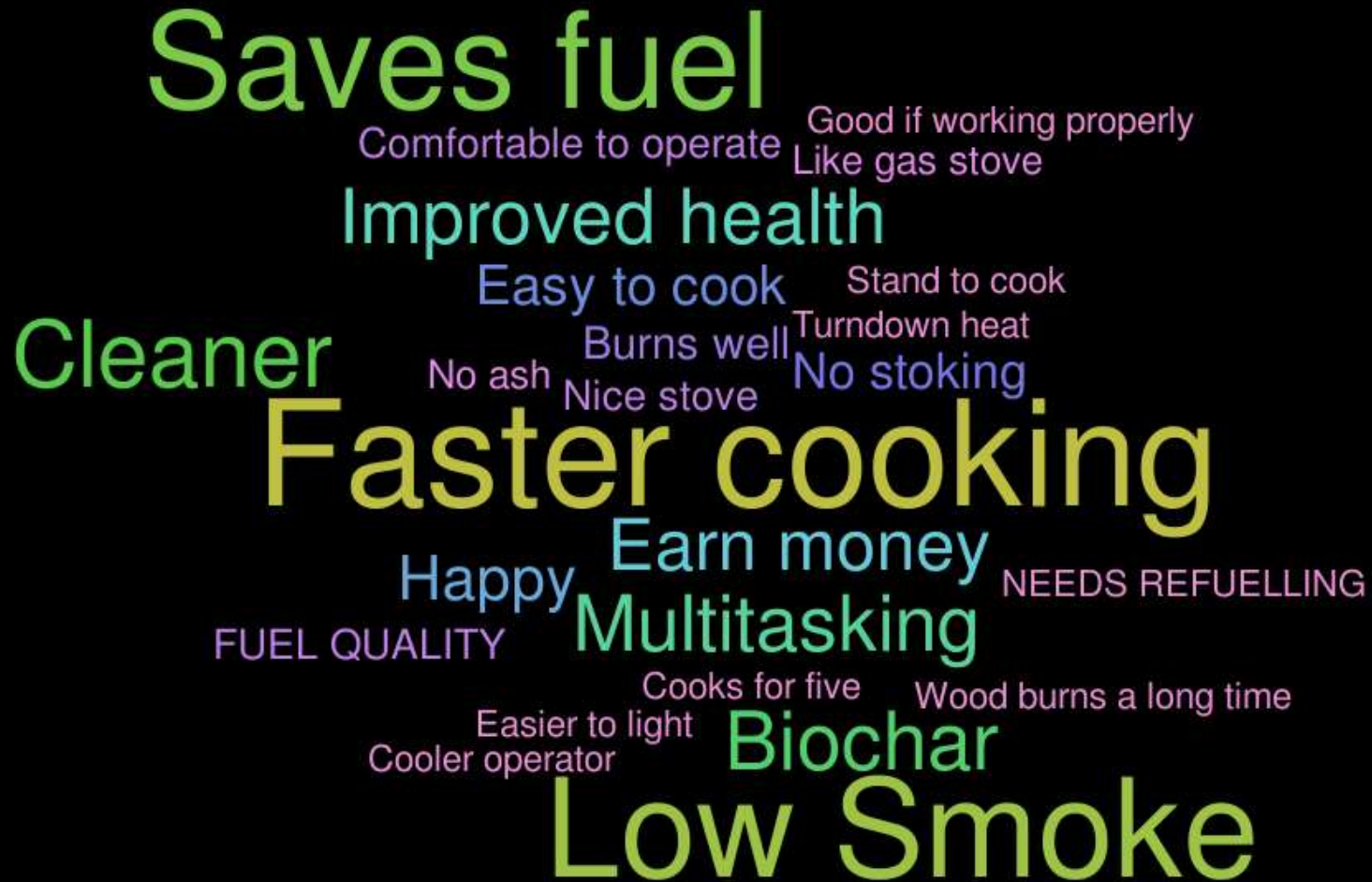
Subjective Experience Index: “What does it feel like?”

| Compared to my other cookstove, I feel that the <i>Akha</i> ... † | Location | | |
|--|---------------------------------------|---------------------|---------------------|
| | Shibalaya | Manda | Daudpur |
| (not counting fuel preparation) | — (mean answer between 0 and 4 ‡) — | | |
| ... is easy to operate; I am not frustrated in making it work. | Mostly (3.7) | Mostly (3.9) | Mostly (3.6) |
| ... is easy to understand; I am confident knowing how it works. | Often (3.4) | Often (3.4) | Mostly (3.8) |
| ... is relaxing to use; I am not rushing to keep up. | Mostly (3.8) | Mostly (3.8) | Mostly (3.5) |
| ... is comfortable to use; I am not hot, in clear air, and standing. | Mostly (3.9) | Mostly (3.7) | Mostly (3.6) |
| ... is a pleasure to demonstrate to visitors. | Mostly (4.0) | Often (3.2) | Often (3.0) |
| ... makes me feel more important in my family. | Mostly (3.9) | Often (3.4) | Often (3.2) |
| ... makes me happy. | Mostly (4.0) | Mostly (3.5) | Often (3.2) |

† Traditional cookstove or Bondhu Chula chimney stove.

‡ Answers: (0) Never, (1) Rarely, (2) Sometimes, (3) Often, (4) Mostly

Women's Overall Impressions of the *Akha*



Fuel Security Index

| In the <u>wet season</u> , how often do you† ... | Location | | |
|--|--------------------------------------|---------------------|---------------------|
| | Shibalaya | Manda | Daudpur |
| | — (mean answer between 0 and 4 ‡) — | | |
| ... burn leaves or straw for cooking? | Never (3.6) § | Never (3.6) | Rarely (2.9) |
| ... burn wood for cooking? | Mostly (3.8) ¶ | Mostly (4.0) | Often (3.3) |
| ... burn liquid or gas fuels for cooking? | Never (0.2) ¶ | Never (0.7) | Never (0.3) |
| ... spend a long time collecting fuel? | Rarely (3.0) § | Sometimes (2.4) | Sometimes (2.1) |
| ... reduce the amount of cooking to conserve fuel? | Often (0.6) § | Often (1.0) | Mostly (0.3) |
| ... worry where the fuel will come from? | Rarely (2.8) § | Rarely (3.1) | Sometimes (2.2) |
| ... worry about the price of wood? | Rarely (3.2) § | Never (3.5) | Never (3.9) |
| | | | |
| Average Fuel Security Index | 2.5 | 2.6 | 2.1 |

† Questions are repeated for the dry season. ‡ Answers: Never, Rarely, Sometimes, Often, Mostly; § Answers are coded 4-0 with 4 being best. ¶ Answers are coded 0-4 with 4 being best.

Fuel Security Index

| In the <u>dry season</u> , how often do you† ... | Location | | |
|--|--------------------------------------|--------------|-----------------|
| | Shibalaya | Manda | Daudpur |
| | — (mean answer between 0 and 4 ‡) — | | |
| ... burn leaves or straw for cooking? | Rarely (2.6) § | Rarely (2.9) | Sometimes (1.7) |
| ... burn wood for cooking? | Often (3.4) ¶ | Mostly (3.6) | Sometimes (2.4) |
| ... burn liquid or gas fuels for cooking? | Never (0.2) ¶ | Rarely (0.8) | Never (0.2) |
| ... spend a long time collecting fuel? | Rarely (2.9) § | Rarely (3.3) | Sometimes (2.2) |
| ... reduce the amount of cooking to conserve fuel? | Mostly (0.4) § | Often (0.8) | Often (0.7) |
| ... worry where the fuel will come from? | Rarely (3.1) § | Never (3.5) | Sometimes (2.2) |
| ... worry about the price of wood? | Rarely (3.3) § | Rarely (3.4) | Never (4.0) |
| | | | |
| Average Fuel Security Index | 2.3 | 2.6 | 1.9 |

† Questions are repeated for the wet season. ‡ Answers: Never, Rarely, Sometimes, Often, Mostly; § Answers are coded 4-0 with 4 being best. ¶ Answers are coded 0-4 with 4 being best.

Rainy Season Fuel

Manda

Price of wood increases

Collect fuel in dry season

Collecting dry wood difficult

Drying fuel difficult
Transporting wood difficult

Daudpur

Wet fuel

Collecting dry wood difficult

Limited fuel storage space

Heavy rain

Land is flooded

Drying fuel difficult

Need to search

Can't access garden

Slippery muddy road

Don't collect fuel in rainy season

Difficult to cook

Collect fuel in dry season

Shibalaya

Hard to get dry fuel

More fuel needed to cook
Fuel collection health risk

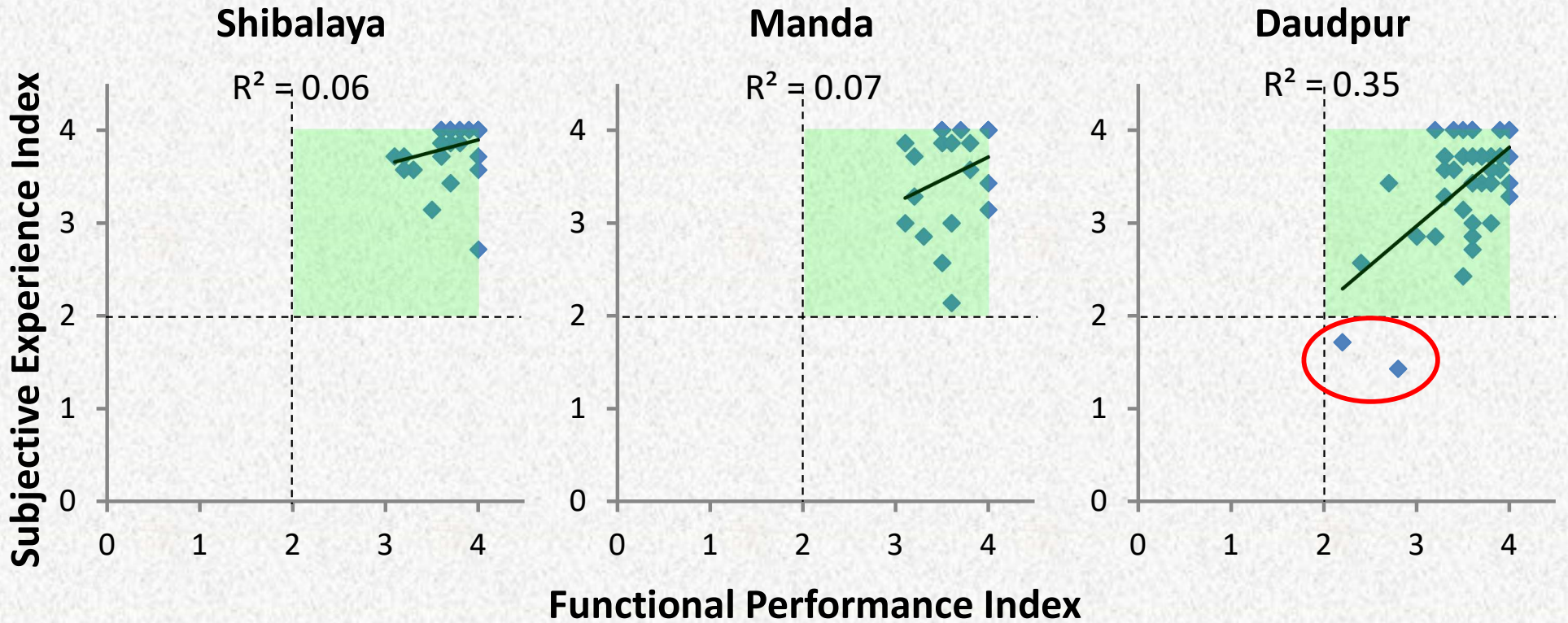
Price of wood increases

Wet fuel
Wet fuel burns less well

Can't get dry fuel

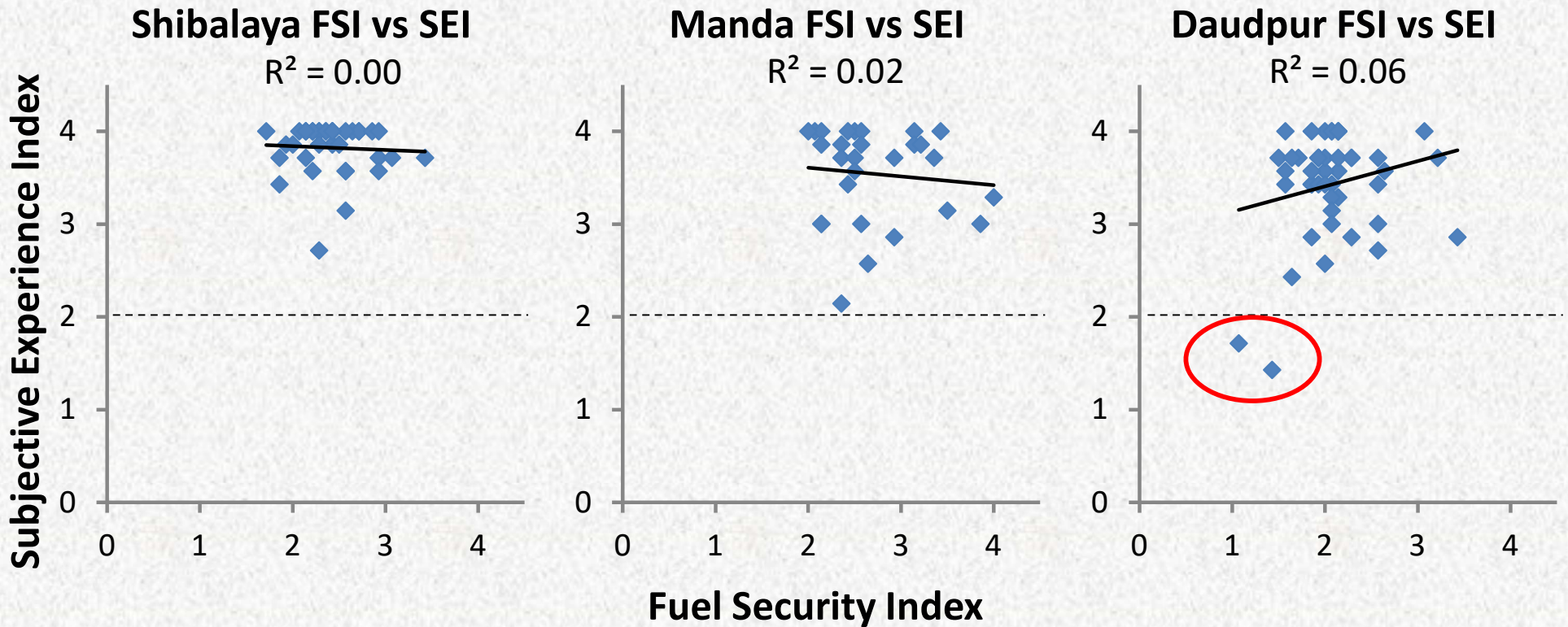
Fuel periodically unavailable

No Correlation Between Subjective User Experience and Akha Functional Performance, Except for Daudpur



Range: 0 (worst) to 2 (indifferent) to 4 (best)
Some points overlap

No Correlation Between Subjective User Experience and Fuel Security Index



Range: 0 (worst) to 2 (indifferent) to 4 (best)
Some points overlap

Are the women using the *Akha* under duress?

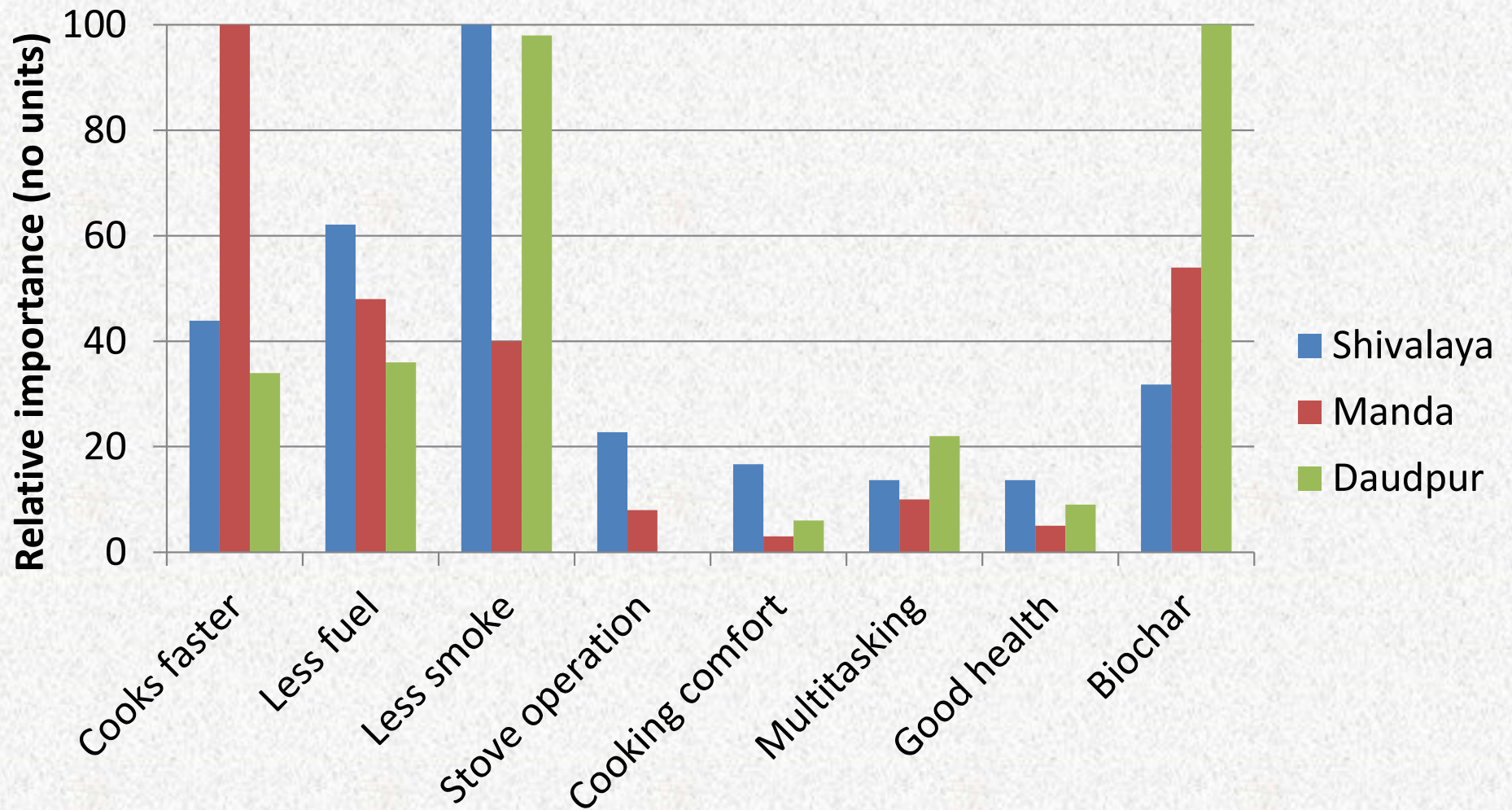
| Do you use the Akha because: | Location | | |
|-------------------------------|-----------|-----------|-----------|
| | Shibalaya | Manda | Daudpur |
| | — (%) — | | |
| (a) you want to, | | | |
| (b) to help your family, or | 41 | 4 | 2 |
| (c) both of the above. | 59 | 96 | 98 |

Would you recommend the *Akha* to a friend?

| Answers | Location | | |
|-------------------------|-----------|-----------|-----------|
| | Shibalaya | Manda | Daudpur |
| | — (%) — | | |
| Strongly No | | | |
| Frequently No | | | |
| Half Yes, Half No ... † | | 4 | 7 |
| Frequently Yes | 22 | 7 | 2 |
| Strongly Yes | 78 | 89 | 91 |
| (No. respondents) | (37) | (23) | (46) |

† or no opinion.

Would you recommend the *Akha* to a friend? Why?



BUG: Homestead Gardens



Mrs. Shewly Begum and her mustard crop



Abraham and Brizida Hajda show the effect of biochar on papaya in their homegarden

Compared to other properties of the *Akha*, such as clean, efficient cooking, **how important is making biochar** in deciding to use the *Akha* rather than another type of stove?

| Answers | Location | | |
|------------------------|-----------|-----------|-----------|
| | Shibalaya | Manda | Daudpur |
| | — (%) — | | |
| Unimportant | | | |
| Somewhat Important | 3 | | 9 |
| Equal to clean cooking | | 13 | 2 |
| Very Important | 68 | 78 | 20 |
| Essential | 30 | 9 | 70 |
| (No. of respondents) | (37) | (23) | (46) |

FARMER BIOCHAR GROUPS

FBG Daudpur



FBG Manda

Mr. Uttam Kumar Pramanic's Trials with Brinjal, Potatos, Onions, and Bitter Gourd



Shamuk Khul Village, Borobelal Daha, Manda

FBG Manda

Mr. Vogirot Tati's potato trial with biochar plus poultry manure and cow dung.



FBG Shibalaya

Aporba Kuner Mondal, Horikrishna Poddar, Akha user Ms. Monkhusi Halder, +farmers



**AGRONOMIC RESEARCH —
COLLABORATION WITH UNIVERSITIES**

Soil Scientists Learn About the *Akha*

Mahbubul Islam and Krishna Kumar Shingha Explaining Gasification



Graduate Student Research — Shibalaya

Professors from BSMR Agricultural University explaining an experiment with chili



Research Collaboration

Mahbubul Islam and Dr. Paritosh Kumar Malaker (Director Training and Communication) BARI



CONCLUSIONS

Conclusions

- The ***Akha* TLUD** was **unanimously well received** for low smoke, saving fuel and saving time, PLUS the biochar as a free by-product.
- As people become aware of the importance of **biochar**, it **will drive the spread of TLUD stoves**.
- We need to **improve the efficiency of the *Akha*** to make better use of scarce wood.
- We need to develop **compressed fuels** to augment wood.
- We need TLUDs adapted to other types of fuels.
- **Biochar could cause a dramatic increase in crop yield on low SOM soils.** Agronomists will research biochar use for advising farmers, and impact assessment.
- **There is an urgent need for TLUD-Biochar research as a means to compensate for land lost from rising sea levels.**

Twenty-five million homes cooks with biomass in Bangladesh.
Can rural Bangladeshis become the largest *per capita* sequesters of carbon on the planet?

Contact us: www.biochar-bangladesh.org

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- **Mr. Joyanta Adhikari**, Executive Director, CCDB for fostering the Akha-Biochar Project and The Bangladesh Biochar Initiative since 2013.
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- **ICCO - International** (Interchurch Organization for Development Cooperation) for three years of essential financial support.
- Our **numerous colleagues at CCDB**

B a n g l a d e s h
B i o c h a r
I n i t i a t i v e



kerk
in actie



Mahbubul and Julien, CCDB Dhaka, 2013

