Low-Tech, Low-Cost, Medium Volume, Merry-Go-Round, 6-Burner TLUD for Farmer or Village Use

Warm Heart Foundation

A.Phrao, Chiang Mai

Thailand

Situation

- Mountain soils badly degraded, highly compacted clays; minimal organic matter; acidic (pH 4.7-5.5), steep with very fast run-off, low water penetration; mountain people cannot afford NPK/urea or liming, if applied, leeches rapidly.
- Valley soils intensely fertilized, mono-cropped, heavily treated with pesticides, yields flat, net returns poor because of input costs

Thailand

- No available sources of biochar
- No publically available data; no extension services, no accessible research programs
- Very limited technological choice: single barrel TLUD designs – unsafe, very low volume, undocumented, unknown
- Great majority of end-users very poor (1/3+ of northern Thai population lives on less than $1.50/day, 10% less than the Thai National Poverty Level) and functionally illiterate
  - Cannot afford NPK fertilizers
  - Require cost-effective production technology and product

Our project

- Design a simple, low-cost biochar burner that:
  - Can be built from locally available materials, preferably recyclables, at little cost;
  - Can be manufactured by local mechanics without training;
  - Can be operated safely and efficiently by a single person;
  - Can use a variety of feed stocks, preferably field waste;
  - Can produce a minimum of 1 ton of biochar per week under normal, unpressured operating conditions.

The 6-burner TLUD merry-go-round: materials list

- 1 x children's playground merry-go-round or equivalent
- 6 x 200 litre steel drums
- 6 x 60 litre steel drums
- 8 x meters 1" OD steel pipe
- 6 x meters 1" angle iron
- 6 x 3" hinges
- Miscellaneous nuts and bolts, welding rods, grinding wheels
- Circular grinder, arc welder

System

- 6 TLUD burners
- 55 kg corn cob load/barrel
- 20+ kg biochar output/barrel
- 120 kg per burn
- Single man can load, light, rotate, load, light, rotate…empty, extinguish, empty, extinguish… all six loads in 1.5 hrs.
- Single man can grind full load in 1.5 hrs.
- Two full loads per day = 240 kg/day
- 6 day week = 1,440 kg/wk
- Feed stock requirement = 3,600 kg/wk
- Cost: corn cob @ 700 baht/ton ($23.35) or $60/ton biochar if farmer does not have own supply

Farmer requirements

- Paddy
  - Standard small-holder may have 5-10 rai (8,000 – 16,000 sq. m).
  - At 1 kg/sq m: 8 to 16 tons or 8-16 wks with our system
  - Cost: $672-$1,344 -> prohibitive if farmer does not have own supply of feed stock
- Coffee
  - Standard planting is 300 plants per rai, 10 rai/3,000 plants
  - 50 cm x 50 cm / plant or .25 sq m: 750 kg or 4 days' production
  - Cost: $63 -> acceptable but high (1,900 baht) if farmer does not have own supply of feed stock

- Critical issue: Does farmer have feed stock of his own?

Drill a grid of ½” holes in bottom of all six 200 litre barrels.

Cut the top off of the barrels below the lip and cross-cut the top to open a star.

Cut the bottom out of all 6 60 liter barrels and cross-cut their tops, fit over the stars at the top of the 200 l. barrels.

Make a “V” of angle iron and attach to hinges. Bolt hinges to side and top of 200 l. barrel.

This will provide a perfect air vent.

Weld a 1” OD steel pipe across the front of the “V” to make a handle.

This makes it easy to open.

Add 1” OC steel pipe handles on the side of each barrel

Bolts are simple and strong.

Mount the barrels on a children's play ground merry-go-round.

Bolt a 1” OD steel pipe off center across the bottom of each barrel.

Weld simple box brackets at each point of the merry-go-round.

The barrel pivot bar fits into the box bracket and a bolt holds it in place.

The merry-go-round in located with one side by the feed stock bins.

Each barrel can be tipped to the bin and filled easily.

On the other side is the extinguishing barrel.

When the biochar is ready, it is dumped into the extinguishing water.

We have made simple tools for raking out the hot biochar.

Next to the extinguishing barrel in the grinder.

Product flow

- Feed stock arrives by pick up truck or the merry-go-round is set up next to a feed stock waste heap.
  - We are not yet experimenting with pre-treatment options
- The grinder is next to the extinguishing barrel.
- Post-treatment options are available after grinder:
  - Drying table for biochar to be treated with NPK and/or clay
  - Compost pile for biochar to be composted

Thank you for your interest

WARMHEART
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