TECHNOLOGY FACTSHEET

MECHANIZATION OF BIOMASS PRODUCTION[1]

1. **Sector**: Energy

2. Introduction:

Based on a study carried out by the Ministry of Science and Technology, the Government of Sri Lanka has declared *Gliricidia sepium* tree as the fourth plantation crop in Sri Lanka. Many thousands of rural communities are engaged in cultivating this crop for a variety of reasons. Woody portions of the mature branches which are periodically harvested are used as fuelwood for industrial heat generation and electricity production. Due to high cost of labour the following activities in the cultivation, harvesting and processing of fuelwood have been encountered:

- Digging holes for planting seedlings.
- Harvesting of mature branches of trees without damaging the main stem.
- Crushing stems to facilitate drying prior to the use as fuel.

At a Stakeholder meeting arranged by the UNDP/ Sustainable Energy Authority (on xxx) the stakeholders emphasized the need to make these technologies available in Sri Lanka. Apart from identifying the source and the types of equipment, no progress has been made to make this technology available in this country. Meanwhile, the increase in the cost of manual labour in Sri Lanka and the subsidy granted for furnace oil are serious barriers for the development of sustainable biomass as a source of energy for industrial heat and electricity generation.

3. Technology Name: Mechanization of Biomass Production

4. Technology Characteristics:

Characteristics of the three machines (auger, harvester and crusher) are given below:

[1] **This fact sheet has been extracted from TNA Report – Mitigation for Sri Lanka. You can access the complete report from the TNA project website** http://tech-action.org/

Earth Auger:

Specifications

Model		AUG-500	
Engine	Brand & model	MITSUBISHI	KAWASAKI
		TB50	TH48
		2 STROKE	2 STROKE
	Displacement	51.7 cc	48.6 cc
	Max output (kw)	2.2	2.2
	Fuel tank capacity	1	1
	Carbure Type	Diaphragm	
	Start System	Recoil Starter	
	Clutch System	Automatic centrifugal	
Drive system	Reduction ratio	35:01:00	
	Drill rotational speed	170 RPM	
Attachment	Extension Shaft	Depth extension = 12" , 18"	
	Drills	Sign-spiral blade	
	Dills diameter	Available choice from 6", 8" , 10"	
	Length	880 mm	
Packing	Weight	8.6 Kg (Without drill)	
	L x H x W	59 x 38 x 27 cm	

http://www.peekayfarmequipments.in/earth-auger.htm

Approximate Cost: Rs. 15,000.00

Harvester:

Suitable ready-made machines to meet the needs of Gliricidia cultivation in Sri Lanka are not available. As per details given below, we need to purchase some of the components and fabricate a system suitable for our needs,.

Pole Saw (M2600)

Product Description
Engine Model:1E34F
Engine Type:Air-cooled , 2 stroke
Displacement :25.4cc
2-cycle oil/Gasoline Mixing ratio:1:25
Ignition :CDI
Power:0.7KW
Carburettor:Diaphragm type
Guide Bar size :10"/12"
Chain Pitch:0.325"
http://great-power.en.made-in-china.com/product/HoImTUQKqPWD/China-Pole-Saw-M2600-.html

Wood Crusher:

The bark in Gliricidia wood acts as a barrier for the escape of moisture. The easiest way to remove the bark from the stem is to crush the stems. Crushers used for crushing sugar cane for sugar extraction are suitable for this purpose. Moreover, crushing of Gliricidia sticks and subsequent shredding would convert Gliricidia wood into small particle suitable for combustion in wood chip boilers. For better efficiency, the pulverized chips could be dried prior to combustion.

Details of some machines suitable for this purpose are given below.

Heavy duty Sugarcane Crusher

Item Code: TYPE-1

Marina Sugar Cane Crushers are ideal machines to extract Sugar Cane juice with uniform extraction rate.

They are sturdy machines in tough working conditions and have proven their quality with low maintenance and reliability.

Technical Specifications

Cane Crushing capacity/hour*	750 - 1000 Kgs
Extraction	60 - 65 %
Power requirement	10 H.P
Speed of Driving Pulley	250 R.P.M
Size of Pulley	30" X 4. ½"
King Roller	8. 5/8" dia X 8. ½"
Crushing Roller	6" dia X 8. ½"
Extracting Roller	6. 1/8" dia X 8. ½"
Net weight	615 Kgs
Gross weight	750 Kgs

- Output Capacity indicated in Kilograms/hr.
- Output Capacity is a technical indication subject to factory testing conditions

Heavy duty Sugarcane Crusher- TYPE II

Item Code: TYPE2-Sugarcanecrusher

Type 2 Sugar Cane Crusher is 3 rollers, Double Roller, horizontal sugar cane crusher.

This machine is specifically designed to give uniformity, higher extraction and considerably greater output for commercial applications.

Technical Specifications

Cane Crushing capacity/hour*	500 - 600 Kgs
Extraction	60 - 65 %
Power requirement	8 H.P
Speed of Driving Pulley	250 R.P.M
Size of Pulley	30" X 4. ½"
King Roller	8. 5/8" dia X 6. ½"
Crushing Roller	6" dia X 6. ½"
Extracting Roller	6. 1/8" dia X 6. ½"
Net weight	590 Kgs
Gross weight	720 Kgs

- Output Capacity indicated in Kilograms/hr.
- Output Capacity is a technical indication subject to factory testing conditions

Feasibility of technology and operational necessities:

Holes for Planting Gliricidia Stems

The establishment of Gliricidia trees as a multipurpose plantation is done by planting Gliricidia stems in the ground, usually at a spacing of 1 meter apart. For this purpose it is essential to dig a hole of about 150 mm in diameter and 300 mm deep. Presently, this task is done by manual labour using steel crowbar. This is a tedious job. A healthy strong man will be able to dig about 32 such holes per day. Hence at the rate of Rs. 1,000 per day, to establish 8,000 trees in a hectare the cost of digging holes would cost Rs. 250,000. At such high cost, Gliricidia based plantations are not viable. With this machine, the above cost would be reduced to Rs. 25,000 per ha. The video in *http://www.sendspace.com/file/6h1enu* demonstrates this.

Harvesting of Gliricidia Branches

Presently the cost of harvesting Gliricidia branches is aroundRs.1,000 per tone of wet wood. On a dry wood basis this is Rs. 2,000 per tonne. At such high cost, use of wood as a source of energy would not be viable. Hence there is a need to mechanize this activity. It is propose to mount a chain saw type of cutter in a suitable cart at a suitable height so that by pushing the cart along the path of Gliricidia trees all the branches of the trees would be cut at that height. The operation could be repeated at the next harvesting cycle.

The estimated cost of harvesting by the proposed method would be reduced to about Rs. 50 per tonne of dry wood.

Crushing of Wood Prior to Drying and Feeding

At present Gliricidia wood is chipped using conventional wood chippers. Wood chips produced by these chippers do not separate the bark from the wood. As a result the moisture in the wood chips remain high. This results in high fuel consumption and difficulty in obtaining desired energy output levels.

The proposed sugar cane crushers are capable of crushing Gliricidia wood into a fibrous materials, thus separating the bark from the stem. This wouldcenable moisture from wood to escape thus facilitating drying. As the bark has ling fiubres, it is essential to send the fibrous materials produced by the crusher through another disintegrater of the type used to make compost out of garden waste. These two types of machines are presently used in Sri Lanka for different applications. With a combination of these two machines, the problem encountered in the fuelwood sector could be solved.

5. Country specific / applicability:

The relevant issues pertaining to this operation in Sri Lanka are as follows:

Furnace oil used by industrialists for the generation of heat energy is heavily subsidized by the government. Therefore, unless fuelwood is marketed at low cost, industries would be reluctant to use fuelwood. Hence to promote biomass energy it is essential that biomass fuel is produced and marketed at low cost.

The cost of labour is increasing day by day. During the last one year it has doubled from Rs. 500 per day to Rs. 1,000 per day. Hence manual labour should used only in extreme situation. Mechanization is an essential way to keep the economy growing.

Modern youth is very reluctant to undertake any manual work. The social stigma attached to manual work is preventing the youth to enter this market. Operating a machine is not considered as a manual job. It is considered as a "Machine Operator" type of job. Hence there is a need to creat such jobs to keep our economy growing.

6. Status of the technology in the country and its future market potential:
This aspect has been already covered in section 4, 5 and 6.

7. Barriers:
This will be written after the completion of Barrier Analysis by the Project Team.

8. Benefits: (How the technology could contribute to socio-economic development and environmental protection)

The following benefits are expected from this mechanization technology:

Social Benefits

- More employment to rural communities in the cultivation, harvesting and delivering of Gliricidia wood to energy conversion facilities.
- More employment for skilled and semi-skilled workforce in the engineering field.

Economic Benefits

- Accelerated establishment of Gliricidia Plantations.
- Availability of adequate quantities of sustainable fuelwood.
- Lower plantation establishment cost.
- Lower fuelwood cost.
- More switching from fossil fuel burning to biomass burning facilities.
- Establishment of more biomass based electricity generating facilities.
- Lesser consumption imported fossil fuels.
- Increase in the production local organic fertilizer.

- Increase in the dairy sector activities

Environmental Benefits

- Lesser local pollution (SOX & NOX) from fossil burning.
- More green cover in the country
- Less pollution from the use of chemical fertilizers

9. **Operations:** *After completion of barrier analysis and only for selected technologies.*

10. **Costs:**

Inquiries made from local merchants who import and supply these items the following cost estimates are reached:

- Hole Digger: Rs. 15,000.
- Harvester: The cost including all necessary fabrication of attachments: Rs. 25,000.
- Crusher and Pulverizer: These estimated cost is Rs. 100,000.

11. **References:**

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12. http://www.peekayfarmequipments.in/earth-auger.htm
13. *http://www.depagro.com/sugarcane-crushers.html*