

# PT MELINDO DIPTA

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## ENGLISH TRANSLATION OF THE INDONESEAN GOVERNMENT REPORT ON SUGARCANE CUTTERS

### PREFACE

Sugarcane cutting, loading and the transport process of sugar cane (TMA) in the sugar industry in Indonesia and even the industry in the world often becomes a "bottle neck". There are so many problems that require attention and require the best solution to solve.

In the harvesting process, the sugar cane is often not properly cut since the butts are left. There is cane left behind in the field and there is cane that falls off the trucks during transshipment and is wasted. It is very ironic that so much work is done to get the optimal growth of sugar cane by good land preparation, planting, care, nurturing but then these profits are lost in the harvesting and delivery. Not to mention the capacity of sugar factories that do not meet supply, will increase new problems, which in turn influence and increases the operational losses of sugar factories.

In the 2010/2011 harvest, PTPN II plans to operate two sugar mills, with capacity of 3400 tons per day for each and need 6800 people per day to cut (the average performance of the cutters is 1 ton of cane per person per day). The management of the labour force is made even worse by the following:

1. The geographical condition of PTPN II, sugar cane plantation is in the vicinity of Medan (capital of province and the third largest city in Indonesia), this causes the people to rather get more respectable jobs than to cut sugar cane which is difficult physical work that is outside (hot, sunny ) and uncomfortable due to the leaves causing a rash.
2. There is lots of infrastructure development in Medan Binjai, Langkat and Deli Serdang that offer better jobs with higher wages.
3. The earning to cut sugar cane is not attractive enough and will rather do other work on the farm than cut sugarcane.

This shows that there has to be a shift toward mechanical harvesting or cutting of sugarcane.

### Time and Place of Visit

Visit was conducted in PT Laju Perdana Indah ( Ogan Komering-South Sumatera ) on 28-30 October 2010.

### The purpose of Visit

The purpose of visit to PT Laju Perdana Indah is as follows :

- a. To have a look and evaluate the performance of cutting tools for sugar cane that operates semi mechanized cutting machinery at PT Laju Perdana Indah Palembang.
- b. To study the feasibility of a mechanical cutting tool to be used in the sugar cane field at PT Perkebunan Nusantara II

## **Benefit of the Visit**

The benefit of this visit report are as follows:

- a. As an input to select the alternative cane cutting machine in operation at the PT Perkebunan Nusantara II
- b. For the authors, the benefit of the visit is to applying this knowledge in the application of agricultural mechanization of sugarcane cultivation
- c. As reference for observers of the sugar industry

## **SUGARCANE HARVESTING**

There are two main ways namely:

- (1) Green cane harvesting
- (2) Burnt cane harvesting.

To harvest either green or burnt cane there is 3 different methods to choose from:

- (1) Manual harvesting
- (2) Semi mechanized harvesting
- (3) Mechanical harvesting

Green cane harvesting is done directly without any other treatment of sugarcane before harvest. Burnt cane harvesting was done after burning to clear the sugar cane leaves.

### **Manually harvesting sugarcane**

Manually harvested sugarcane harvesting is done in two ways:

- (1) Cut and Windrow.  
The cane is cut and left in a windrow where it is then loaded with a bell.
- (2) Bundle cane  
The sugarcane is cut and tied into a bundle and loaded manually.

Steps to be taken in Cut and Windrow method (Soepardan, 1988)

- (a) It will be detashed
- (b) The base will be cut
- (c) Topped
- (d) Sticks will be placed in a row. Usually 4-6 rows in a single row and put at right angles to the line.

Bundle Cane harvesting is done similarly but will be tied off in a bundle using a green top

### **Mechanically Sugarcane harvesting.**

Factors which cause sugar cane harvesting done mechanically are as follows :

- (1) Difficulty in obtaining sugar cane cutters.
- (2) Cane cutting labor can only work for 8 hours during the day while the sugar cane harvesting machine can work for 24 hours
- (3) Capacity of sugarcane harvesting machines is much greater than manual cane cutting
- (4) The maximum time for sugarcane harvest is relatively short so that the use of sugar cane harvesting machines (Sugarcane harvester), especially in areas with limited

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manpower, will be able to resolve the harvest activities at a given time, so that losses can be reduced.

Factors generated in the fields where sugar cane harvesting machines operated which affect the efficiency of time and cost of harvesting are the following:

- (1) Slopes
- (2) Shape of the field
- (3) Ridge height and width
- (4) Cleanliness of land from foreign objects.

Mechanical harvesting of sugar cane can be done in two ways:

## **(1) Using Whole stalk Harvester**

Whole stalk Harvester cutting the sugar cane in the base of the stem near the soil surface, then brought back and arranged into a windrow for subsequent loading.

## **(2) Using Chopper Harvester**

Chopper Harvester's cut the sugar cane at the base and then it is fed into the harvester where the cane is cut again into shorter pieces called billets with a size 20-40 cm (Gentil and Ripolli 1977).

Each cane harvester has some advantages and disadvantages. Harvesting using a Chopper Harvester will be more profitable than whole stalk Harvester under certain conditions.

The process for a single unit of sugar cane chopper harvester generally be described as follows (D 1986)

- Arrange the sugarcane stem in a row into the cane cutters
- Cut the cane top
- Shake the sugarcane cut stems to separate the sugar from the soil and sand.
- Cutting the cane into billets
- Move the billet with conveyor
- Throw away the trash and light material
- Load the billed for transport.

## **RESULT OF THE VISIT**

A. Application for the semi mechanical canethumper machine and Thrasher tools.

- For the cane thumper application it is only the cutter and to lay the cane it requires 6-8 people.
- The result of the Cane thumper application is as follows :
  - Capacity : 0,14 Ha/hour = 10 MT / hour = 70 MT / day
  - Quality : Solid , flat and the cutting result is that not broken into pieces
  - Quantity of manpower : 1 operator & 8 assistance / day ( per 70 MT)
  - Fuel requirement : 0,5 Litre / hour

For topping and cleaning a thrasher was used. The test result for the thrasher (Leaf removal ) is the following :

- Capacity : 1,2 MT / hour
- Quality of the work : clean cane (thrash 0 %)
- Quantity of manpower : 1 people

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## B. Application for Semi Mechanical TAGRM and Harvester and Thrasher.

The use of Semi Mechanical sugar cane cutting TAGRM is cutting the rootstock (base cutter) and lays the cane in a windrow. The Thrasher is used to cut the cane tops and detrash.

Result for the TAGRM Harvester testing is as follows:

- Capacity : 0,11 Ha / hour = 8 MT / hour = 56 MT / hour
- Quality : Solid, and flat, good result for the cane cuts but some are broken into pieces.
- Quantity of manpower : 1 operator and 1 assistance / day per 56 Mt
- Fuel requirement : 2,5 Litre / hour

While to cut the cane top and cleaning the trash use thrasher (leaf removal)

## PLANNING FOR THE APPLICATION OF MECHANICAL EQUIPMENT AT PTPN II

### A. The application of the CaneThumper

The CaneThumper cutting tool if implemented in PTPN II can be operated well enough to help overcome the shortage of manpower.

It caused by the following factor:

- The equipment is relatively small so that mobility / maneuver on land bends can be done quickly.
- The sugar cane cutters are double action cutting that allows working at a high speed and gives an excellent cut.
- Germany-made machine types that include environment friendly with the very low fuel needs (0.5 - 1 ltr / hour) and minimal maintenance.
- Result of the cut piece of cane cane are low and it saves the re-cutting cost of Rp. 220 000/ ha and increase productivity as much as 1.2 MT / ha of sugar cane / ha (equivalent to Rp 600.000 / ha with the assumption the immersion is 6.5% and sugar prices Rp. 7500 / kg)

The weakness of the tools if applied in at PTPN II are as follows :

- The Cane Thumper only cuts the rootstock part (base cutter) and still needs manpower which also has to adjust with the Cane Thumper cutting speed.
- The need of male manpower to equalize the speed of the Cane Thumper due to they are stronger while 90% of the manpower in PTPN II are woman.
- The working culture of sugar cane cutters in PTPN II is individually based, where the individual activity of each worker influence their income, while the job of using the cane thumper is in a team.
- The carrying and transportation of the harvested sugar cane is a high risk job.

The plan to use Cane Thumper in PTPN II, must be considered from the following points:

- The composition of Cane Thumper, thrasher and man power need are as follows :
  - Cane thumper unit : 1 unit
  - Thrasher unit : 5 unit
  - Man power : 2 people
    - Operator : 2 people
    - Manual power : 18 unit.

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The above composition producers approx 70 mt /day.

- In terms of operational manual labor required adaptation and dissemination of work patterns and culture (from individuals to teams./group)
- In the case of manual operation of the CaneThumper needs an ergonomic method and better safety by doing the following:
  - Determine the danger zone boundary that should not be entered by manually man power.
  - Choose the best alternative work patterns according to workers in terms of convenience / comfort and safety level. Alternatives are as follows
    - Workers carried the cane as it applies in PT Gunung Madu Plantation and PT Laju Perdana Indah
    - Application of Indian method, using ropes pulled by workers.
    - Application of the Brazilian Method, using the supple and strong bamboo drawn by the workers.

## B. Application of semi Mechanic TAGRM Harvester at PTPN II

There are some advantage and disadvantage of the usage of semi mechanic cane cutting tool TAGRM sugar as follows:

The advantage if applied at PTPN II is as follows

- If we compare with Cane Thumper , the TAGRM Semi mechanic machine use less manpower
- The result of the cutting is solid and flat, reduce the cutting cost approx Rp. 220.000 / Ha and increase the productivity of the cane around 1.2 MT / Ha ( Equal to Rp 600.000,- / Ha with the assumption 6.5 % immersion and price of sugar is Rp 7.500 / kg

The disadvantage of the tools if applied at PTPN II is as follows:

- The length of the tool is relatively long and does not allow to turn quickly, thus affecting the performance of the tool (wasting so much time to turn the instrument).
- The cane vegetation which are partially lodged, decrease the performance of the TAGRM cutter.
- Still require manual cutting man power to cut headlands to enable the machine to turn

## Comparison between CaneThumper with Thrasher against manual cutting.

Description	CaneThumper	100 % manual cutting
Quality of the cuts	<ul style="list-style-type: none"> <li>- Solid, flat some are broken to pieces</li> <li>- Thrash 0%</li> </ul>	<ul style="list-style-type: none"> <li>- Not solid</li> <li>- Leave behind &gt; 5 %</li> </ul>
Capacity	<ul style="list-style-type: none"> <li>- 0,14 Ha/hour = 8 MT / hour with the assuming that the production capacity is 70 MT / Ha</li> <li>- 9 hour / Ha</li> <li>- 70 MT / Day</li> </ul>	Average 1 MT / HA Assuming productivity is 70 MT /Ha 70 people / Ha

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Manpower requirement for 1 Ha / 70 Mt	18 people	70 people
Operational cost	Cane Thumper Rp 15.100,-/Mt	
	Thrasher Rp. 8.166,-/Mt	
	Man power Rp. 6.482,-/Mt	Man power Rp. 22.000/Mt
	Supervisor Rp. 7.800,-/Mt	Supervisor Rp. 17.300/Mt
	<b>Total Cost Rp. 34.548,-/Mt</b>	<b>Total cost Rp. 39.300/Mt</b>

## ECONOMICAL ANALISYS

- A. Operational cost
- Cane thumper cost : Rp. 8.300,- / Mt
  - Thrasher cost : Rp 8.166,-/ Mt
  - Manual manpower fee : Rp. 12.857,-/ Mt
  - Supervisor, incentive etc : Rp. 8.700,-/ Mt
  - Total cost Rp. 38.023,-/ Mt**

The operational cost using the tools are lower compared to manually cut cane

- Manual man power fee Rp. 22.000,-/Mt
- Supervisor etc Rp. 17.300,-/Mt
- Total cost Rp. 39.300,-/Mt**

B. Cost Ration Benefit Analysis

From the procurement of new machinery like Cane Thumper and Thrasher, the Analytical Benefit Cost Ratio are as follows:

### Procurement of Machinery

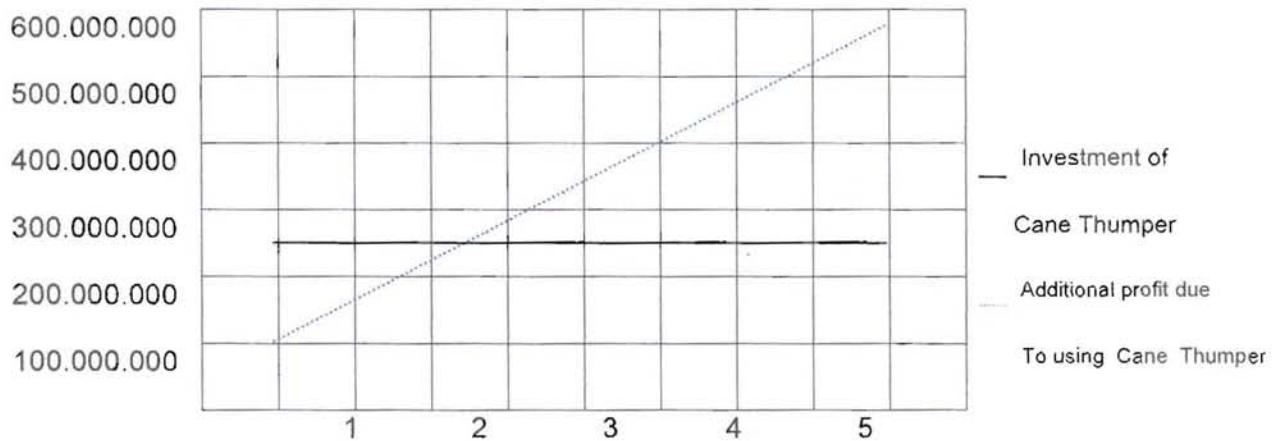
#### COST BENEFIT

No	Year	Description	Rp
1	I	Difference compared to manually cut ( Rp 1.277 x 70 Mt x 120 day )	10.726.800,-
		Income Cut Cost ( Rp 220.000 x 120 Ha )	26.400.000,-
		Increase of the sugar cane production (1,25 Mt cane / Ha x 120 Ha. With immersion 6.5 % and price of sugar Rp 7500/Kg	72.000.000,-
		<b>Total first year</b>	<b>109.126.800,-</b>
2	II	Ditto with first year	109.126.800,-
3	III	Ditto with first year	109.128.800,-
4	IV	Ditto with first year	109.126.800,-
5	V	Ditto with first year	109.126.800,-
		<b>Total benefit for 5 years</b>	<b>545.634.000,-</b>

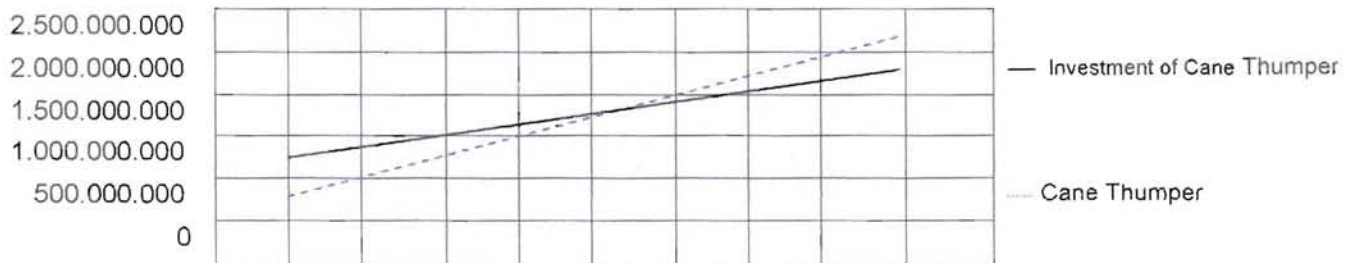
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- From the Benefit Cost Analysis if they use Semi Mechanic tools like Cane Thumper they will get Rp. 293.643.000,- / in 5 years.
- Break Even Point Analysis  
By investing a Cane Thumper, 5 units thrasher and 1 unit mini loader results obtained with the use of these tools is as follows:



If we compare the revenues and operating expenses are as follows



From the chart above, and the calculated interpolation the investment of 1 unit Cane Thumper, 5 units of Thrasher and 1 unit mini loader will be able reaches break-even point (BEP) after 2,3 years ( 2 years and 3.5 months).

## C. Investment Feasibility Analysis

Investment feasibility analysis of semi-mechanical cutting tool Cane Thumper, Thrasher and Mini Loader using the IRR( Internal Rate of Return) method is as follows :

- Capital  
The investment of Cane Thumper, Thrasher and mini loader = RP 250.000.000,-
- Operational cost 1 year ( Rp. 38.023,- x 70 MT / day x 120 days ) = Rp 319.393.200,-
- Period of management = 5 years
- Obtaining result for 1 year

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Manual cutting fee : ( Rp. 39.300 x 70 MT / day x 120 days	330.120.000,-
Cutting fee (Rp 220.000 x 120 Ha )	26.400.000,-
Sugar cane product increase (1.25 Mt / Ha x 120 Ha) with the assumption that the redemption of sugar cane is relatively Rp. 7.500,-)	72.000.000,-
	428.520.000,-

## CONCLUSION AND SUGGESTIONS

### A. CONCLUSION.

- a. Facing the milling season year 2010 in PTPN II, which for the continuous supply of cane require 6800 manual cane cutters.
- b. Looking at the availability of the existing cutters during this time it is very difficult to meet the requirements so a mechanical cutting device that can reduce the need for manpower can meet the supply of sugarcane to sugar mills
- c. From the test results of the cutting tool can be concluded up as follows
  - ~ The use of semi-mechanical cutting tools Cane Thumper, Thrasher and mini loader and leaf cleaning can be technically and economically used at PTPN II
  - ~ The use of semi-mechanical cutting tool TAGRM harvester technically **still requires** testing and further developments to make it a viable solution.
- d. The use of semi mechanical cutting tool at PTPN II still requires adaptation to consider the change in behavior in culture for the cane cutters.

### B. SUGGESTION

- a. Considering the large gap between the requirement and the availability of manpower to cut sugarcane the Cane Thumper and Thrasher are worth considering using.
- b. The TAGRM harvester needs further testing and adaptations before considering.