5.4 How to Move the Machine in the Plantation

The machine can be manoeuvred in the plantation either by a motorcycle or a pushing cart. A motorcycle with a sidecart carrying collecting equipment can move around the plantation. However, the manœuvrability is limited as it cannot move backward or is not able to collect the wastes near the tree trunks. A 2-wheel push cart in the same fashion as a lawnmover is considered superior to the motorcycle because it is easy, simple and less capital cost. It has a better manœuvrability and suits to the surface irregularity.

5.5 How to Densify the Wastes

Biomass densification machines can be classified as piston press, screw press, pellet press and manual press (Eriksson and Prior 1990). Past experience in many places showed that the screw press was successfully used to densify many kinds of biomass. Thus, a screw press was chosen as a study model.

6. ECONOMIC ANALYSIS OF RUBBER PLANTATION WASTES

Detailed economic analysis is given in Appendix A. It was analysed that the annualized capital cost was estimated at 13,458 Baht/year. The annual operating cost depends on the size of the screw press. The sizes of the screw presses selected for the analysis are 20 and 4 kW. This will effect the total annual cost as summarized in Table 6.
Table 6

Annualized Cost of Waste Acquisition and Densification

Annualized capital cost independent of size of the screw press (see Appendix A). Assume the rubber leaves are obtained free of charge.

<table>
<thead>
<tr>
<th>Power of press (kW)</th>
<th>ACC (Baht)</th>
<th>AOC (Baht)</th>
<th>Total annual cost (Baht)</th>
<th>Working period (month/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20*</td>
<td>13,458</td>
<td>51,588</td>
<td>65,046</td>
<td>2.5</td>
</tr>
<tr>
<td>4*</td>
<td>13,458</td>
<td>44,907</td>
<td>58,365</td>
<td>12.5</td>
</tr>
</tbody>
</table>

ACC = Annualized Capital Cost.
AOC = Annual Operating Cost.
* Electricity cost 2.43 Baht/kW-h

The annual income was estimated at 19,888 Baht. It is obvious that the waste utilization is not economically feasible if electricity gets involve in the processes. If a diesel engine is a prime mover the break even cost for the fuel is -13,643 Baht/year which is not possible. It can be concluded that mechanization for the waste collection-densification is technically possible but is not economically feasible.

7. ALTERNATIVES FOR WASTE UTILIZATION*

It is quite clear that the densified leaves is not a desirable end product because it, although serves the objectives of the project in the sense of reducing fire hazard, is not different from fuelwood. The densified wastes can not compete with the fuelwood because the fuelwood in the rubber growing region is

* This section was not included in the proposal but the authors believed it is worth to study.