FINANCIAL ANALYSES ON D4 TAPPING AS ALTERNATIVE TO D3 IN RUBBER PLANTATION OF SOUTH SUMATRA

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Abstract

Rubber plantations are experiencing unfavorable conditions with the decline in rubber prices and the increase in cost of production, particularly the cost of tapping. Therefore, it is required to explore the tapping systems to optimize the production so that the revenue could cover the cost of production. This paper is aimed to ascertain the minimum production that should be achieved to cover the production cost through the implementation of S/2 d4 low intensity tapping system. The analysis were conducted by using S/2d3+Ethrel and S/2d4+Ethrel tapping system with three scenarios; the yield with S/2d3 tapping system is 1000 kg/ha/year, 1200 kg/ha/year and 1500 kg/ha/year. Only the tapping cost was considered as a variable cost in overall cost of production. Further, a sensitivity analysis was conducted to investigate the effect of rubber price and wages on the profits. It was shown that the profits given at yield levels of 1000, 1200 and 1500 kg/ha/year in S/2d3 tapping system could be achieved by the yield levels of 757, 957 and 1257 kg/ha/year in S/2 d4 tapping system. If there is a change in rubber price or wages from the present level, S/2 d3 should provide a productivity over 1000 kg/ha/year whilst with the S/2 d4 tapping system, the production level of more less than 1000 kg/ha/year is sufficient to obtain profits even with 20% decline in rubber prices and 20% increase of wages. Other implications in the adoption of S/2 d4 system are also discussed.

Keywords: low intensity tapping system, tapping cost, profit, rubber price

INTRODUCTION

Currently, rubber based agribusiness is experiencing unfavorable condition. This is due to the decline in of rubber price in the last few years as well as increase in cost of production especially the cost of tapping. Although rubber price has reached the highest peak in 2011, since then it had continued to decline up to the level of USD 1.38 per kg. In early 2017, rubber price bounced back to USD 2.2; however by June 2017, rubber price again returned to a low level of USD 1.43 per kg (SICOM, 2017).

In addition to the decline in rubber price, the increase in production cost is another factor that has negative impact on rubber based agribusiness. Tapping cost is the highest component of production cost (40%-60% of the total of production cost) (Karyudi and Junaidi, 2009; Sivakumaran, 2013). The increase in tapping cost was mainly caused by
the increase in wages of tapper (Figure 1). According to a rubber plantation in South Sumatra, the wage of tapper was Rp 50,000/day in 2011; however, it has increased to Rp 90,000/day with an average rate of about 13% per year. This has burdened the stakeholder of rubber business. Other costs that affect the cost of production are the price of agricultural production input (fertilizer, pesticide, herbicide) and agricultural machinery as a result of inflation and implementation of government subsidy abatement/abolition (Hendratno and Amypalup, 2008).

Figure 1. Minimum Wages of South Sumatra Province, 2005-2016

Reducing the frequency of tapping is a way of reducing the cost of tapping and overcome the problem of tapper scarcity in some rubber centre areas. Low rubber price has encouraged some rubber estates to decrease the frequency of tapping from d3 to d4 tapping system. The experience of one private estate in Jambi (Kurnia, 2015) showed that with S/2 d3 tapping system, the average productivity per ha was between 1500-2000 kg/ha/year, with the output per tapper per day was between 17-22 kg of dry rubber. Meanwhile, with S/2 d4 tapping system, productivity in the first year has reached 1,200 kg/ha/year and in the second year has reached 1,500 kg rubber/ha/year. The output per tapper in the first and in the second year has reached 22-25 kg of dry rubber per tapper per day.
Furthermore, the study of Chong Kewi and S. Sivakumaran in Kurnia, 2015 (Performance of Low Frequency Tapping System) showed that low intensity tapping systems comprising S/2 d3, S/2 d4, S/2 d6 could decrease the necessity of tappers by 33%-67% from the level of S/2 d2 and increase land : man ratio up to 6 with S/2 d6 tapping system. Also, studies with some clones have shown an increase in gram/tree/tapping with the decreasing of tapping frequency from S/2 d2 to S/2 d3, S/2 d4 or S/2 d6, which was about 70, 80, and 100 gram, respectively. Production per tapping is an important factor to reduce costs.

This is in line with the results of Kudaligama et al. (2013) in Srilanka that the use of S/2 d3 and S/2 d4 tapping system could reduce the production cost compared to S/2 d2 tapping system, as well as reduce the needs of tapper as many as 33% and 50%, respectively. In addition, the implementation of low intensity tapping system could save bark consumption so that could maximize the economic life of rubber plants. However as experienced by Hai et al. (2013) and Nang (2015), the decrease of tapping intensity in PB 260 clone could increase gram/tree/tapping by 15-20%, but the average productivity (kg/ha/yr) would decrease due to the decrease of tapping day. Productivity of S/2 d4 tapping system on PB 260 clone with stimulant would give the productivity that is almost equal with S/2 d3 tapping system (Hai et al., 2013).

In general, the decrease in tapping intensity will have the following effects: (1) increased labor productivity; (2) decreased in land productivity, bark consumption, labor requirements; and (3) the effect on latex physiological parameters. Kudaligama et al. (2010) stated that in general, the incidence of Tapping Panel Dryness (TPD) is found more severe in high intensity tapping systems, so that in the reduction of tapping intensity there is no indication on the increase in TPD affected trees . The study of Hai et al. (2013) showed that in PB 260 clone, the incidence of TPD in S/2 d4 was less than that in S/2 d3 tapping system.

Based on the above mentioned information on low intensity tapping systems, this study was aimed to investigate the sustainability of adopting d4 tapping system in place of d3 in terms of achieving the required yield level and minimizing the tapping cost.
MATERIAL AND METHOD

The data analyses were conducted under three productivity based scenarios of S/2d3+Ethrel tapping system and adoption of S/2d4+Ethrel in place of S/2d3+Ethrel tapping system. The productivity scenarios were on of 1000 kg/ha/year, 1200 kg/ha/year and 1500 kg/ha/year. Some other assumption used were:

1. Rubber price was the price of TSR20 in Mei 2017 with 85% of FOB. The average price of TSR 20 in Mei 2017 was USD 1.53 with the exchange rate of Rp 13,264 so that the price assumed was Rp 17 250,- per kg of dry rubber.
2. Variable cost comprised only the tapping cost; other costs are assumed to be constants
3. The price and cost of production such as labor cost, material and tools for tapping as well as processing cost were based on the price where the estate located.
4. Economic unit of the analysis was 1 ha of rubber plantation with a tree density of 550 trees/ha.

The calculation of minimum production was conducted with Break Even Point (BEP) approach between production of S/2 d3+Ethrel and S/2 d4+Ethrel so that it was obtained the cutting point between these two tapping systems. The formula used as follow:

\[ \begin{align*}
B_{D3} &= B_{D4} \\
R_{D3} - C_{D3} &= R_{D4} - C_{D4} \\
P \cdot Q_{D3} - C_{D3} &= P \cdot Q_{D4} - C_{D4}
\end{align*} \]

Therefore, BEP of d4 = \( Q_{D3} - C_{D3}/P \cdot C_{D4}/P \)

where:
- \( B_{D3} \) = Benefit of S/2d3+Ethrel tapping system (Rp)
- \( B_{D4} \) = Benefit of S/2d4+Ethrel tapping system (Rp)
- \( R_{D3} \) = Revenue of S/2d3+Ethrel tapping system (Rp)
- \( R_{D4} \) = Revenue of S/2d4+Ethrel tapping system (Rp)
- \( C_{D3} \) = Cost of S/2d3+Ethrel tapping system (Rp)
- \( C_{D4} \) = Cost of S/2d4+Ethrel tapping system (Rp)
- \( Q_{D3} \) = The yield of S/2d3+Ethrel tapping system (kg/ha/year)
- \( Q_{D4} \) = The yield of S/2d4+Ethrel tapping system (kg/ha/year)
- \( P \) = Rubber price (Rp/kg)
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Furthermore, the sensitivity analysis was conducted to analyze the effect of the changes of rubber price and wages of tapper towards the critical levels of production in S/2 d3 and S/2 d4 tapping systems. The scenarios of sensitivity analysis were included:

- Rubber price decrease 10% and 20%
- The wages of tapper increase 10% and 20%
- Rubber price decrease 10% and the wages of tapper increase 10%
- Rubber price decrease 10% and the wages of tapper increase 20%
- Rubber price decrease 20% and the wages of tapper increase 10%
- Rubber price decrease 20% and the wages of tapper increase 20%

RESULT AND DISCUSSION

Analyses of Productivity based Break Even Point in S/2 d4 Tapping System

Summary of the productivity based break even point analysis of S/2 d4 tapping system against the S/2 d3 is given Table 1. Accordingly, when the production of S/2 d3 was 1000 kg/ha/year, the production of S/2 d4 should only be 757 kg/ha/year to get the same benefits. Also when the production of S/2 d3 was 1200 kg/ha/year, the production of S/2 d4 should only be 957 kg/ha/year for same financial benefits. Similarly, the same profit given by S/2 d3 at 1500 kg/ha/year could be achieved by S/2 d4 with 1,257 kg/ha/year. Therefore, the production (kg/ha/year) obtained from S/2 d4 could decrease as much as 24% in order to get the same benefits in S/2 d3 tapping system. In terms of tapping cost, the decrease of tapping frequency would decrease the tapping cost as much as 26%.

Table 1. Analyses of Productivity based Break Even Point in S/2 d4 tapping system

<table>
<thead>
<tr>
<th>Production (kg/ha/year)</th>
<th>D3 + Ethrel</th>
<th>D4 + Ethrel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Revenue</td>
<td>Cost of tapping</td>
</tr>
<tr>
<td>1000</td>
<td>17,249,832</td>
<td>16,326,050</td>
</tr>
<tr>
<td>1200</td>
<td>20,699,798</td>
<td>16,326,050</td>
</tr>
<tr>
<td>1500</td>
<td>25,874,748</td>
<td>16,326,050</td>
</tr>
</tbody>
</table>

Note: only cost of tapping was considered in calculation
Sensitivity Analyses of the Changes of Rubber Price and Wages of Tapper Towards the Production of S/2 d3 and S/2 d4

Under dynamic economic conditions the fluctuation of price and cost is inevitable; hence, it is required to analyze how is the effect of the changes of rubber price and wages of tapper towards the productivity based break even point of S/2 d4 tapping system. From the analyses on the changes of rubber price and wages of tapper, it was known that S/2 d3 tapping system suffers from losses if the production mentioned in the previous scenario is maintained (i.e. 1000 kg/ha/year, 1200 kg/ha/year, and 1500 kg/ha/year). Details of profits/losses of S/2 d3 tapping system with three scenarios of production are presented in Table 2.

Table 2. Sensitivity analysis the changes of rubber price and wages of tapper towards the benefit/losses of S/2 d3 tapping system

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Profit/ Losses at the productivity of 1000 kg/ha/year (Rp/year)</th>
<th>Profit/ Losses at the productivity of 1200 kg/ha/year (Rp/year)</th>
<th>Profit/ Losses at the productivity of 1500 kg/ha/year (Rp/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubber price decrease 10%</td>
<td>-801,201</td>
<td>2,303,769</td>
<td>6,961,223</td>
</tr>
<tr>
<td>Rubber price decrease 20%</td>
<td>-2,526,184</td>
<td>233,789</td>
<td>4,373,748</td>
</tr>
<tr>
<td>The wage increase 10%</td>
<td>-209,678</td>
<td>3,240,288</td>
<td>8,415,238</td>
</tr>
<tr>
<td>The wage increase 20%</td>
<td>-1,343,138</td>
<td>2,106,828</td>
<td>7,281,778</td>
</tr>
<tr>
<td>Rubber price decreased 10% and the wage increase 10%</td>
<td>-1,934,661</td>
<td>1,170,309</td>
<td>5,827,763</td>
</tr>
<tr>
<td>Rubber price decrease 10% and the wage increase 20%</td>
<td>-3,068,121</td>
<td>36,849</td>
<td>4,694,303</td>
</tr>
<tr>
<td>Rubber price decrease 20% and the wage increase 10%</td>
<td>-3,659,644</td>
<td>-899,671</td>
<td>3,240,288</td>
</tr>
<tr>
<td>Rubber price decrease 20% and the wage increase 20%</td>
<td>-4,793,104</td>
<td>-2,033,131</td>
<td>2,106,828</td>
</tr>
</tbody>
</table>

Note: - the number followed by (-) sign showed losses
- only cost of tapping was considered in calculation

As shown in Table 2, if the production of S/2 d3 tapping system is 1000 kg/ha/year, the planters would suffer from losses along with the decrease of rubber price or the increase of wages of tappers or with both. Furthermore, if the production from S/2 d3 tapping system is 1200 kg/ha/year, the planters still suffer from losses if the rubber price decrease along with the increase in wages. Meanwhile, if the production achieved by the S/2 d3 tapping system is 1500 kg/ha/year, the planters would get profits under the conditions tested for the decrease of rubber price and the increase of the wages of tapper.
Furthermore, it is needed to calculate the minimum production that must be achieved on the S/2 d3 and S/2 d4 tapping systems if there is a decrease in rubber prices and increased in wages of tappers. The results are shown in Table 3. Accordingly, it is known that if there is a change in price or wages, then the production that must be achieved by S/2 d3 tapping system should be greater than 1000 kg/ha/year to achieve profits. Meanwhile, with the S/2 d4 tapping system, the production level of more less than 1000 kg/ha/year is sufficient to obtain profits even with 20% decline in rubber prices and 20% increase of wages.

Table 3. Minimum Production that should be achieved by S/2 d3 and S/2 d4 tapping system in the condition of decline in rubber price and increase in wages of tappers.

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Minimum Production (kg/ha/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S/2 d3 + Ethrel</td>
</tr>
<tr>
<td>Rubber price decrease 10%</td>
<td>1,052</td>
</tr>
<tr>
<td>Rubber price decrease 20%</td>
<td>1,183</td>
</tr>
<tr>
<td>The wage increase 10%</td>
<td>1,012</td>
</tr>
<tr>
<td>The wage increase 20%</td>
<td>1,078</td>
</tr>
<tr>
<td>Rubber price decreased 10% and the wage increase 10%</td>
<td>1,125</td>
</tr>
<tr>
<td>Rubber price decreased 10% and the wage increase 20%</td>
<td>1,198</td>
</tr>
<tr>
<td>Rubber price decreased 20% and the wage increase 10%</td>
<td>1,265</td>
</tr>
<tr>
<td>Rubber price decreased 20% and the wage increase 20%</td>
<td>1,347</td>
</tr>
</tbody>
</table>

Note: only cost of tapping was considered in calculation.

**Technical Advantages of Low Intensity Tapping System**

Implementation of low intensity tapping system has several technical advantages. At the frequency of d3, the need for tappers is 0.3 per hectare whereas with d4 that is only 0.25 per hectare. In other words, the lower the frequency of tapping, the lesser the demand for tappers. In addition, with a decrease in the frequency of tapping, there was a decrease in bark consumption from 15 cm/year in S/2 d3 tapping system to 12 cm/year in S/2 d4 tapping system.

The change of tapping system from S/2 d3 to S/2 d4 may decrease the average of land productivity. However, this can be addressed by adjusting the stimulation protocol of S/2 d4 to provide the same yield given by S/2 d3 (Rodrigo et al., 2011) and this has been the basic concept in developing low frequency tapping system. Nevertheless, the
productivity of gram per tree per tapping (g/p/s) inevitably increases with the decrease of tapping intensity (Nang et al., 2015; Herlinawati and Kuswanhadi, 2013).

CONCLUSIONS

1. The implementation of S/2 d4 tapping system is the right alternative to replace S/2 d3 tapping system that has been implemented for a long period in rubber plantations in South Sumatra
2. The implementation of S/2 d4 would decrease the total yield, however it could be corrected with the adjustment in the stimulation protocol. Anyhow, S/2 d4 system increases the yield per tapping and labor productivity
3. With S/2 d4, the productivity at 1000 kg/ha/year is still sufficient to cover the costs even with 20% decrease of rubber prices along with 20% increase in wages of tapper.

SUGGESTION

Analysis conducted in this paper was the partial budget analysis, therefore, further analysis is required including all production costs (all fixed and variable costs).

REFERENCE


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