STUDY ON DIFFERENT TAPPING PERIOD IN RUBBER FOREST PLANTATION

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ABSTRACT

In Malaysia, rubber wood is one of the most popular planted wood and in high demand by domestic furniture industry. However, with the decline in replanting hectarage, the demand for rubber saw logs will in the near future exceed that of supply. Therefore, establishment of rubber forest plantation (RFP) is one alternative to the anticipated problem. Despite wood is the primary yield in the RFP, the latex production still becomes one of priority to collect. Therefore, this study intends to evaluate the effect of tapping on latex yield, growth and wood volume from a different age of open taping. In this study, the latex harvesting practices for the RFP is designed to achieve 1800 to 2000 kg/hectare/year from the first year of tapping. After 4 years study, apply of tapping system, i.e. S/2 d3 6d7 and S/2 d3 stimulant 5% La 8/y 6d7 during open tapping at year 8 showed the highest tree productivity by 68-84 gram/tree/tapping (g/t/t) followed by open during the year 9 around 48-62 g/t/t and year 7 by 47 g/t/t. In addition, the stimulant application increased the latex yield up to 26 % compared to without stimulant application. When land productivity was concerned, all treatments resulted average productivity above 1800 kg/ha/year and tapping system S/2 d3 stimulant 5% La 8/y 6d7 during open tapping at year 8 gave the highest productivity from the first year of tapping period. Meanwhile, the highest bole wood volume was shown during open tapping in the year 8 by 0.20 m^3, followed by the year 7 around 0.17 m^3, and year 9 by 0.15-0.16 m^3. However, there was no significant difference in wood volume among the treatments. The open tapping in year 8 showed the highest girth increment by 0.8-4.0 cm/6month, followed by the year 9 around 0.8-2.0 cm/6 month, and year 7 with 0.6 cm/6month. Moreover, the results showed that as the early open tapping, the girth will decrease and the bole height will increase. As a conclusion, the timing of latex extraction and stand at the time of tapping will affect yield and adversely affects girthing rate and hence log volume per tree. Therefore, the open tapping during year 8 using S/2 d3 stimulant 5% La 8/y 6d7 could be suitable latex harvesting practices for the RFP compared to open at year 9 due to high latex production and optimum timber. However, the wood quality and economic point of view need to carry out to figure whether a reduced gestation phase and longer latex extraction period may improve cash flows and investment returns on the project.

Key words: Rubber forest plantation; latex harvesting practices; tree productivity; land productivity; wood volume

Introduction

For the last 80 years, rubber tree (*Hevea brasiliensis*) has been planted for latex extraction. Nowadays, rubberwood is popularly known as the alternative to some timber species. Furniture from rubberwood has contributed about RM 5.06 million to the country's export earnings, showing its demand and popularity (Anon, 2014). With the decline in replanting hectarage, the demand for rubber saw logs will in the near future exceed that of supply. Establishment of rubber forest plantation (RFP) is one alternative to the anticipated problem.

The hectarage of rubber plantation area in Malaysia dropped from 1.25 million hectares in 2008 to 1.07 million in 2013 (Anon, 2014). This situation was reflected to the reduction of rubber production in Malaysia and in order to meet the demand of downstream sector, Malaysia has to import 905,041 tonnes of NR worth RM 5.83 billion in 2014. In relation to that, higher density planting known as the RFP was introduced to sustain the supplies of timber and latex. The RFP is a short cycle, i.e. 15 years as compared to conventional 25 years, which specifically for the exploitation of wood with an option for latex exploitation if desired from the 9th until the 15th year before falling on the 16th year. Meanwhile, the rates for fertilizer were half as given to the conventional rubber plantation. The recommended density from 450 trees per hectare was increase to 625 trees per hectare in order to optimum wood volume for solid timber and latex production. The trees will be left untapped for 8 years to allow for better girth and wood volume development. Thereafter trees will be tapped 7 years prior to timber harvesting. There are two types of clones suitable for RFP i.e. latex timber clones and timber clones (Mohd. Nasaruddin, 2005). Although suitable clones have been identified, lack of information on practical latex harvesting and cost effective practices must be addressed.

Currently, the prediction of latex harvesting practices for the RFP is designed to achieve 1800 to 2000 kg/hectare/year from the first year of tapping. It is based on estimation of tree productivity ranging from 36 to 40 grams of dry rubber/tree/tapping (g/t/t), with 550 tappable trees per hectare and 90 tapping days per year (d3 tapping frequency). For a short planting cycle concept, the latex harvesting technique is different from conventional planting where the tapping is carried out only on basal panels i.e. BO-1

and BO-2 (Mohd Akbar and Ang, 2011). The timing of latex extraction and stand at the time of tapping also affects both yields per tree and per hectare. Latex extraction adversely affects girthing rate and hence log volume per tree. However, results from financial analyses carried out on the various options indicated that options involving both latex and wood extractions provided higher net returns compared to those involving only wood extraction. This is attributed primarily to latex being the major revenue contributor providing more than 80% of total revenue (Johari *et al*., 1995). Future investments in rubber must consider shorter periods of investment cycles for both wood and latex extraction.

Therefore, this study will try to evaluate the latex productivity at different age of the tree in order to find a suitable time to open tapping to sustain vigour of *Hevea* for optimum latex yield and timber. Besides, the most interesting part is to monitor the wood volume when tapping is carried out, which to answer speculative question are tapping system drastically reduce the growth rate of the trees and subsequently reduce the wood volume which later reduces the total wood volume per hectare and revenue per hectare. For that purpose, several differences tapping systems of latex harvesting have been tested in different open tapping, i.e. open during the year 7, year 8, and year 9. These techniques are able to determine the suitable time to open tapping in the RFP and give optimum latex production. In addition, the wood volume change also can be monitored. The results of four years of the study on latex yield and wood volume are presented in this paper.

Materials and methods

Study site

The study was carried out at Penawar Division, Rubber Research Institute Experimental Station (RRIES) Kota Tinggi, Johore, Malaysia (1º 33’ 56.12’’ N, 104º 14’ 40.32’’ E). This area is located in southern of Malaysia and characterized by an equatorial climate with an average annual rainfall 1200 mm.

Planting material

The study was focused on Latex timber clone (LTC) RRIM 3001 (IAN 873 x PB 235) where the tree was one of the recommended clones to be planted in the RFP. The trees were planted in 2003 with planting density 625 per hectare. The study started in 2010, i.e. 2010 for open tapping for 7 years, 2011 for open tapping at 8 years, and 2012 for open tapping at 9 years after planting.

Experimental design

The design was based on a randomized completed block design (RCBD) where consisted of three treatments (i.e. Different tapping period) within every plot contained stimulant and without stimulant application. The entire plots laid out randomly and repeated in two plots. The details studies were:

T1: Open tapping at 7 years; 8 years latex exploitation; 15 year cycle

T1a: S/2 d3 stimulant 5% La 8/y 6d7

T2: Open tapping at 8 years; 7 years latex exploitation; 15 year cycle

T2a: S/2 d3 6d7

T2b: S/2 d3 stimulant 5% La 8/y 6d7

T3: Open tapping at 9 years; 6 years latex exploitation; 15 year cycle (Control)

T3a: S/2 d3 6d7

T3b: S/2 d3 stimulant 5% La 8/y 6d7

Meanwhile, open tapping during year 7, only treatment S/2 d3 stimulant 5% La 8/y 6d7 was being applied due to the expectation that the early open tapping the lower the latex yield can be collected and applied without stimulant not suggested.

Measurements

The yield was estimated by weighing coagulated rubber or called cuplump of each plot every alternate day. For each treatment, cuplump was used to determine tree productivity (gram per tree per tapping (g/t/t)) and the land productivity (kg/ha/yr). The girth was measured at 150 cm above the ground. The bole wood volume was measured by using calculations from girth and bole height and was expressed in cm^3/year.

Statistical analysis

All data obtained were analyzed using softwares Prism 5 and Excel for analysis of variance (ANOVA). The level of significance of the differences between averages was estimated by the Newman-Keuls test at a limit of 5%.

Results

Tree productivity

The trees tapped at different open tapping period provided different g/t/t pattern over 4 years (Table 1). During the study (2010-2014), the trees under T1 application already achieved four years tapping cycles, followed by T2 with three year cycles, and T3 with two year cycles. The g/t/t under T2 showed the highest, followed by T3 and T1, with total average range 68-84g/t/t, 48-

62g/t/t, and 47g/t/t, respectively. During the first year of tapping, trees tapped under T2b showed highest g/t/t compared to other treatments in the same period of time and the pattern was similar during the second and third years tapping. In addition, the application of stimulant 5% gave better g/t/t compared to without stimulation, as shown in T2b and T3b.

Land productivity

The average productivity was highest under T2 during the first year tapping and the trend was similar over 4 year study (Table 2). During open tapping for 8 years, i.e. T2, total average was around 2700 to 3200kg/ha/year, followed by T3 with 1900 to 2500kg/ha/year, and T1 around 1800kg/ha/year. During the first year of tapping, trees tapped under T2b showed highest land productivity compared to other treatments in the same period of time and the pattern was similar during the second and third years tapping. The application of active matter (ethephon) increased the productivity where T2b and T3b gave higher compared to without stimulation application.

Table 1: Average tree productivity of the clone RRIM 3001 under different tapping period over 4 years

Open	Treatment	Tapping period (g/t/t)				
		Y1	Y2	Y3	Y4	Average g/t/t
Year 7	T1a	35.38±2.18a	51.79±2.98a	55.4±2.90a	46.69±5.11	47.32±4.36b
Year 8	T2a	71.21±2.58a	71.32±5.17a	61.87±2.47a	na	68.39±5.03ab
	T2b	97.91±10.10b	81.94±4.54a	73.16±6.82b	na	84.34±7.25a
Year 9	T3a	46.34±5.46a	51.24±6.73a	na	na	48.79±6.09b
	T3b	62.65±4.96a	61.98±6.56a	na	na	62.32±0.34b

Data are expressed as means ± S.E. Mean values in columns with same superscripts are not significantly different (p>0.05)

na: no tapping period

Table 2: Average land productivity of the clone RRIM 3001 under different tapping period over 4 years

Open	Treatment	Tapping period (kg/ha/year)				
		Y1	Y2	Y3	Y4	Average kg/ha/year
Year 7	T1a	1332a	2018a	2232a	1840	1855b
Year 8	T2a	2713a	2713a	2869a	na	2765ab
	T2b	3730b	3122a	2948b	na	3266a
Year 9	T3a	1847a	2120a	na	na	1983b
	T3b	2497a	2551a	na	na	2524b

Mean values in columns with same superscripts are not significantly different (p>0.05)

na: no tapping period

*Tappable trees per hectare used was taken to be 438 trees/ha (70% from 625 trees/ha)

Growth performance

The trees tapped at different open tapping period provided different growth performance pattern over 4 years (Table 3). Showed that as early open tapping, the girth will decrease and the bole height will increase. Meanwhile, there was no significant difference in bole wood volume between open tapping where the average range was around 0.15 to 0.22 m^3/tree. However, showed that the trend of high wood volume was during open tapping at year 8, followed by at year 7, and the year 9.

Table 3: The girth & height increment and wood volume of the clone RRIM 3001 under different tapping period at 11 years after planting

Open	Treatment	Height increment (cm/6mths)	Girth increment (cm/6mths)	Bole height (cm)	Girth (cm)	Bole wood volume (m^3/tree)
Year 7	T1a	35.09a	0.65a	550.28a	63.39a	0.17±0.00a
Year 8	T2a	36.05a	1.62a	536.63a	71.79a	0.22±0.03a
	T2b	58.91a	4.09a	534.55a	73.28a	0.22±0.00a
Year 9	T3a	17.00a	0.87a	491.43a	62.03a	0.15±0.02a
	T3b	35.77a	2.00a	517.69a	62.35a	0.16±0.05a

Data are expressed as Mean ± S.E. Mean values in columns with same superscripts are not significantly different (p>0.05)

Discussion

Generally, untapped trees could be used to produce high quality sawn timber without any tapping scars and higher wood recovery. However, this is not suitable for who depend solely on their rubber trees for a source of income. So, when begin to tap the trees, it must be tapped appropriately to avoid any tapping scars, which may affect the quality of the woods that are processed into sawn timber. Besides, the latex production must be high for it to be economical for extraction as a secondary produce. For a short planting cycle concept (i.e. rubber forest plantation) the latex harvesting technique is different from conventional systems.

The tapping in the RFP is targeted to achieve yields range from 1800 to 2000 kg/ha/yr for 7- 9 years of tapping compared to less than 1500 kg/ha/yr for conventional system during the first 7 to 9 years of tapping. As shown in the study, the application of S/2 d3 6d7 achieved the average land productivity from 1800 to 2600 kg/ha/year during 4 years study. In addition, the active ingredient (latex stimulant 5%) is strongly increasing the latex productivity around 22-26% as shown in S/2 d3 stimulant 5% La 8/y 6d7 during open tapping at 8 and 9 years after planting. In addition, the application of stimulant 5% maintains the land productivity from the 1st year of tapping up to 1800 kg/ha/year. Therefore, latex stimulant 5% is strongly suggested by the opening of tapping. The primary reasons are the shorter harvesting period, which is only 7 to 9 years versus 20 to 25 years of tapping for conventional system. Besides, the tapping is carried out only on panel BO-1 and BO-2. In addition, the latex harvesting technique in this study was design based on the stand per hectare at planting is 625 trees/hectare and is expected that the tappable stand per hectare (TSPH) at opening for tapping will be about 550 trees/hectare and the tappable trees will not markedly increase in the future. Although the tree productivity (g/t/t) is expected to be lower than that of the similar clones planted in the conventional rubber estate, it is possible to achieve *a* yield of 1800 to 2000 kg/hectare /year because of high TSPH.

Meanwhile, open tapping during 7 year, only treatment S/2 d3 stimulant 5% La 8/y 6d7 was being applied due to the expectation that the early open tapping the lower the latex yield because of latex vessels in the tree. The result also showed that although with the application of stimulant 5%, the latex productively still low compared to treatment in the year 8 and 9. Thus, the application without stimulant is no really suggested. However, the open tapping during 8 year gave better yields compared to open in 9 year and this was different as we expect. This observation could due to high viscosity in latex in the year 9 thus will reflect the latex flow during tapping. Meanwhile, the bole wood volume was not significant between each tapping period. It could due to different effect on girth and bole high which become parameters to determine wood volume. The results showed that as the early open tapping, the girth will decrease and the bole height will increase. When correlate to latex productivity, the girth is the most important compare to bole height, thus we need to delay the open tapping for certain time. However, during the year 9, the girth increment was slow and we expect that the growth performance was slow after 8 year and open tapping at 8 year is the best practice compare to waiting for 9 year.

Conclusion

The study showed that the design of latex harvesting techniques in RFP can achieve land productivity above 1800 kg/ha/year. In addition, the results showed that the timing of latex extraction and stand at the time of tapping will affect latex yield and adversely affects girthing rate and hence wood volume per tree. Therefore, the open tapping during the year 8, using a tapping

system of S/2 d3 stimulant 5% La 8/y 6d7 could be suitable latex harvesting practices for the RFP compared to open at year 9 due to high latex productivity from the first year of tapping and optimum wood volume. However, the wood quality and the economic point of view need to carry out in the future to figure whether a reduced gestation phase and longer latex extraction period may improve cash flows and investment returns on the project.

Acknowledgement

The authors thank the management of the Malaysian Rubber Board for allowing the paper to be published in the IJAFP. Contribution from the staff of MRB in field maintenance and data collection are well appreciated.

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