

# Optimization of latex production on rubber slow starter clones IRR 42 through application of multiple exploitation system

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**Abstract.** Rubber is one of the important agricultural commodities. The low production of latex due to the low quality of tapping because the application system of exploitation that does not comply with the clones. Rubber has two groups of clones is a quick starter and a slow starter. This study aims to determine the system of exploitation that can increase the production of slow starter clone IRR 42, but still maintain the plant physiological stability. The system exploits tested were tapping system and intervals giving stimulant. The experiment was conducted at the experimental farm of Rubber Research Institute of the White River, covering applications in the treatment field and Physiology Laboratory analysis in the White River Rubber Research Institute, North Sumatera. The study took place from October 2012 to December 2012. This research conducted with randomized block design with two treatments and three replications. Tapping system (S) consists of 5 levels: S<sub>0</sub> = 1/2s d/3.ET 2.5% (control); S<sub>1</sub> = 1/4S ↑ d / 3.ET 2.5%; S<sub>2</sub> = 1/4S ↑ d/3.ET 2.5% + 1/2Sd/3; S<sub>3</sub> = 1/2s d/3.ET ↑ 2.5%; S<sub>4</sub> = 1/2s ↑ d / 3. ET.2.5% + 1/2Sd/3 and interval giving stimulants (W) consists of 2 levels: W<sub>1</sub> = 1 time a month; W<sub>2</sub> = 2 times a month. The system of exploitation affect plant physiological conditions, which increase the dry rubber content, the content of sucrose, lower thiol content results, and increase the content of organic phosphate, but the physiological condition of the plant is still quite normal and does not cause stress in plants. Tapping system that produces the highest production is S<sub>4</sub> (1/2s ↑ + 1/2Sd/3 d/3.ET.2.5%) and lowest in S<sub>1</sub> (1/4S ↑ d/3.ET 2.5%). Highest dry rubber content is S<sub>4</sub> (1/2s ↑ + 1/2Sd/3 d/3.ET.2.5%) and lowest in S<sub>1</sub> (1/4S ↑ d/3.ET 2.5%).; Highest thiol levels S<sub>1</sub> (1/4S ↑ d/3.ET 2.5%) and lowest in S<sub>4</sub> (1/2s ↑ + 1/2Sd/3 d/3.ET.2.5%); levels of sucrose and organic phosphate levels are highest S<sub>4</sub> (1 / 2S + 1/2Sd/3 ↑ d/3.ET.2.5%) and lowest in S<sub>1</sub> (1/4S ↑ d/3.ET 2.5%). Intervals giving stimulants that produce the highest production is W<sub>2</sub> (2 times a month) and lowest in W<sub>1</sub> (1 time a month). Highest dry rubber content is W<sub>2</sub> (2 times a month) and lowest in W<sub>1</sub> (1 time a month); highest levels of thiol is W<sub>1</sub> (1 time a month) and lowest in W<sub>2</sub> (2 times a month); levels of sucrose and the highest levels of organic phosphate is W<sub>2</sub> (2 times a month) and lowest in W<sub>1</sub> (1 time a month).

**Key words:** System of exploitation, production, slow starter clones.

## Introduction

Rubber is one of the leading Indonesian plantation commodities, but annual production is still low when compared to the other countries of rubber manufacturers. This was caused by the low quality and the implementation of the system of exploitation tapping plants in the field are not in accordance with the characteristics of the clones, so many droughts the tapping grooves. By the time reached peak production, rubber grouped into 2 groups: a quick starter (QS) and a slow starter (SS). Exploitation of the system can be applied selectively according to the characteristics of clones.

Exploitation of rubber trees is done with the use of stimulants and leads the system towards the top (SKA). Stimulant aims to optimize crop production potential. Stimulant treatment is more effective in clones that have a high response (Sumarmadji, 2005). In

addition to stimulant application, the application is also tapping system is an effort to improve crop productivity. How to exploitation of rubber plants made during this is to do with the leads downward (SKB). Intercepts in this way tend to be more susceptible tappinggroovesresult in dryness (Junaidi and Kuswanhadi, 1997). Leads down to the suspected cause disconnection between tapping the header field. This resulted in lesssmoothlatexregenerationprocess, theflow of photosynthatewhichisthe manufacture of latex inhibited. In addition, it leads down to the drainage area will further reduce latex, with theimminentslicestappingintoengagementgrafting (elephantiasis) (Sivakumaran et al, 1985). Upward tapping system (ACS) has long been recognized, with the advantages of this system is the relationship between the field of tapping the plant canopy is maintained so that the crops blockage symptoms can be avoided and more effectiveassimilationflow (Junaidi&Kuswanhadi, 1997). Besides latex flow velocity will increase because it is supported by the force of gravity. Alsoaccordingto (Lukman, 1996), upwardtappingsystem (ACS) can produce higher than downward tapping system.

Slow starter clone (IRR 42) used in this study have good growth (robust), resistant to wind, but problems in the field, this clone have low production. This study was conducted to determine the system of exploitation aimed to increase the production of low metabolism Clone IRR 42, but still maintain the stability of plant physiological, through the provision of testing interval and system stimulant tapping.

### **Materials and Methods**

The research was conducted in October 2012 to December 2012 at RubberResearchInstitute Experimental StationSungei White, Deli Serdangregency, North Sumatra. With altitude of 25 m above sea levelwiththetypeUltisol. Thisstudyconductedwitrandomcompletelydesignwith two treatment factors, namely tapping system (S) and the interval giving stimulants (W). Factor tapping system (S) has five levels while providing interval system stimulant factor (W) has two levels. Factor tapping system: S0 = 1/2s d/3.ET 2.5% (control); S1 = 1/4S ↑ d/3.ET 2.5%; S2 = 1/4S ↑ d/3.ET 2.5% + 1 / 2SD / 3; S3 = 1/2s d/3.ET ↑ 2.5%; S4 = 1/2s ↑ d/3.ET.2.5% + 1/2Sd/3. Factor delivery system stimulants: W1 = 1 time a month and W2 = 2 times a month.

Materials used in this study is the IRR 42 rubber clones planted six years old 2006/2007 at a spacing of 5 mx 2.5 m. Girth ranged from 45.9 to 47.4 cm and 7.48 -7.93 mm thick skin. Number of initial stand each clone 800 trees / ha. At the time of the study was in the field of tapping panel; B0-1 (first virgin skin), with a height of about ± 70 cm of linkage grafting. Before treatment, exploitation systems were implemented, namely ½ s / d 3 (half spiral downward, the intervalintercepts 3 days) and 2.5% stimulantethepon.

### **Exploitasi Treatment**

Tappingfrequency of 3 days of (d / 3).Applicationstimulant use ethepon (2-chloroethyl phoeponicacid) with a concentration of 2.5%. Giving stimulants administered via skin application of tapping areas that have been scraped (bark application) 2.5 cm wide, the interval of one month (B1) and twice a month (B2). Diluent (carrier) are in use and water is provided in accordance with the experimental treatment.

Variabels in this study : latex production (g / p / s), Potential production (kg / ha / yr), Levels of dryrubber (DRC), - Levels of sucrose (mM), - Inorganicphosphateconcentration (mM), - Thiolslevels (mM)

### Results and Discussion

Rubber production (g / tree / tapping), potentialproduction, dryrubberlevel, thiol, sucrose, phosphatorganiconthe treatment system and the tapping interval delivery system stimulant in October, November and December are in Table 1.

Based on observations during 3 months (October to December) is generally known that the treatment of the highest production in the treatment S4W2 (1/2s tapping system d/3.ET.2.5%  $\uparrow$  + 1/2Sd/3 and interval 2 times a month) , while the lowest production on S1W1 treatment (1/4S  $\uparrow$  d/3.ET 2.5% and 1 time a month interval) (Table 1).

Table 1. Production per tree per tapping (g / p / s), potential production (kg / ha / year), dryrubberLevels (%), thiolconcentration (mM), sucroseconcentration (mM), and PI concentration (mM) in the treatmenttappingsystems and delivery interval system stimulant

Treatment	Production per tree per tapping (g/p/s)	potential production (kg/ha/year)	dry rubber Levels (%)	thiolconcentration (mM)	sucroseconcentration (mM)	PI concentration (mM)
S <sub>0</sub>	41,44	3647,01	53,36	0,532	4,64	6,62
S <sub>1</sub>	24,16	2125,98	52,42	0,542	4,43	6,37
S <sub>2</sub>	45,76	4027,08	53,54	0,480	4,87	6,97
S <sub>3</sub>	34,74	3057,36	53,20	0,482	4,47	6,58
S <sub>4</sub>	56,39	4961,98	54,13	0,455	5,47	7,46
W <sub>1</sub>	38,24	3364,85	53,22	0,503	4,76	6,76
W <sub>2</sub>	42,76	3762,92	53,43	0,493	4,79	6,84
S <sub>0</sub> W <sub>1</sub>	38,86	3419,58	53,36	0,543	4,60	6,61
S <sub>0</sub> W <sub>2</sub>	44,03	3874,44	53,35	0,522	4,68	6,63

S <sub>1</sub> W <sub>1</sub>	21,84	1921,72	51,98	0,540	4,45	6,40
S <sub>1</sub> W <sub>2</sub>	26,48	2330,24	52,86	0,543	4,41	6,35
S <sub>2</sub> W <sub>1</sub>	43,71	3846,28	53,58	0,484	4,84	6,87
S <sub>2</sub> W <sub>2</sub>	47,82	4207,87	53,49	0,475	4,90	7,08
S <sub>3</sub> W <sub>1</sub>	35,36	3111,88	53,22	0,480	4,49	6,61
S <sub>3</sub> W <sub>2</sub>	34,12	3002,85	53,18	0,485	4,45	6,55
S <sub>4</sub> W <sub>1</sub>	51,42	4524,76	53,98	0,469	5,42	7,34
S <sub>4</sub> W <sub>2</sub>	61,35	5399,19	54,28	0,442	5,52	7,58

- The same figures followed the same letter do not differ at P 0.05

From observation of the production parameters shows that the potential to get high productivity in general to S4W2 treatment ( $\uparrow$  1/2s tapping system d/3.ET.2.5% + 1/2Sd/3 and interval 2 times a month), while the lowest production on S1W1 treatment (tapping system d/3.ET 1/4S  $\uparrow$  2.5% and 1 time a month time interval). That the highest KKK in treatment S4 (1/2s  $\uparrow$  + 1/2Sd/3 d/3.ET.2.5%) is 54.13%, and the lowest S1 treatment ( $\uparrow$  1/4S d / 3. ET 2.5%) is 52.42%. Intervals of treatment delivery system stimulant obtained in treatment W2 (2 times a month) is 53.43%, and the lowest in W1 treatment (1 time a month) is 53.22%. The treatment S4W2 KKK (1/2s tapping system d/3.ET.2.5%  $\uparrow$  + 1/2Sd/3 and interval 2 times a month) KKK higher than the other treatments, while the lowest KKK in treatment S1W1 (tapping system d/3.ET 1/4S  $\uparrow$  2.5% and 1 time a month time interval). The best system for tapping the sucrose content of the parameter is treated S4 (1/2s  $\uparrow$  1/2Sd/3 d/3.ET.2.5% +) is 5.47 mM, and the lowest S1 treatment (1 /  $\uparrow$  4S d/3.ET 2.5%) is 4.43 mM. Intervals of treatment delivery system stimulant obtained in treatment W2 (2 times a month) is 4.79 mM, followed by treatment with W1 (1 time a month) is 4.76 mM. The average levels seen that treatment S1W2 thiol (tapping system d/3.ET 1/4S  $\uparrow$  2.5% and the time interval 2 times a month) and lowest Thiolnya higher in treatment S4W2 (tapping system 1/2s  $\uparrow$  d / 3 . ET.2.5% + 1/2Sd/3 and interval 2 times a month). The best system for tapping the sucrose content of the parameter is treated S4 (1/2s  $\uparrow$  1/2Sd/3 d/3.ET.2.5% +) is 5.47 mM, and the lowest S1 treatment (1 /  $\uparrow$  4S d/3.ET 2.5%) is 4.43 mM. Intervals of treatment delivery system stimulant obtained in treatment W2 (2 times a month) is 4.79 mM, followed by treatment with W1 (1 time a month) is 4.76 mM. The highest sucrose concentration on treatment S4W2 (1/2s tapping system d/3.ET.2.5%  $\uparrow$  + 1/2Sd/3 and interval 2 times a month) and lowest in S1W2 treatment (tapping system 1/4S  $\uparrow$  d/3.ET 2.5% and the time interval 2 times a month). The best system for tapping the levels of PI parameters are treated S4 (1/2s  $\uparrow$  1/2Sd/3 d/3.ET.2.5% +) is 7.46 mM and the lowest in the S1 treatment (1 / 4S d/3.ET  $\uparrow$  2.5%) is 6.37 mM. Intervals of treatment delivery system stimulant obtained in treatment W2 (2 times a month) is 6.84 mM, followed by treatment with W1 (1 time a month) is 6.76 mM. The highest levels of PI in

treatment S4W2 (1/2s tapping system d/3.ET.2.5%  $\uparrow$  + 1/2Sd/3 and interval 2 times a month) and lowest in S1W2 treatment (tapping system 1/4S  $\uparrow$  d/3.ET 2.5% and the time interval 2 times a month). (Table 1).

System of exploitation and use of stimulants used aiming to increase production, and the results showed no significant difference between the combination of the two treatments. Treatment by tapping two-way system stimulant twice a month and showed higher production, which is demonstrated by the production parameters (g / tree / tapping) and production potential. Highest production and the potential for the highest production obtained on treatment followed by treatment S4W2 S2W2, S4W1, S0W2, S2W1, S0W1, S3W1, S3W2, S1W2, and S1W1. The production data shows that the two-way system of exploitation and giving stimulants twice a month then production is higher, while the one-way system of exploitation and administration at intervals of one month of production is lower.

Positive response given by the plant and the tapping system stimulant administration twice a month at intervals associated with the plant material used is rubber clones belonging IRR 42 Clones slow starter. IRR 42 has the advantage of good growth (robust) and resistant to wind but the problems in the field latex production is low. However, in this study the results obtained with the response of these clones and exploitation system stimulant administration. By giving the exploitation system stimulant and heavier than the control turns these clones showed an increase in production compared to controls. Treatment system is the most intensive exploitation S4W2 thus resulting higher production supported by the provision of more stimulants with interval twice a month. The system exploits S4 = 1/2s  $\uparrow$  d/3.ET.2.5% + 1/2Sd/3 by administering stimulants at intervals of twice a month led to an increase in production, as is done with two-way leads that lead up and down. Giving stimulants to support the production of the system exploits the heavier it is in accordance with Sumarmadji (2005) which states that stimulus aims to optimize crop production potential. Stimulus treatment is more effective in clones that have a high response. In this study IRR 42 clones capable of producing at a more severe exploitation system with the help of stimulants, these clones showed a response to stimulants. According Sumarmadji (2009) which includes SS clone one IRR 42. Exploitation of the system can be applied selectively according to the characteristics of clones obtained optimal production. IRR 42 according to the characteristics of the stimulant exploitation of the response seen in this study.

On treatment S4 = 1/2s  $\uparrow$  + 1/2Sd/3 d/3.ET.2.5%, S2 = 1/4S  $\uparrow$  d/3.ET 2.5% + 1/2Sd/3, S3 = 1/2s  $\uparrow$  d / 3.ET 2.5%, S0 = 1/2s d/3.ET 2.5%, S1 = 1/4S  $\uparrow$  d/3.ET 2.5%. Highest production obtained in treatment S4, due to the system of double tapping crop yield higher production. By tapping both directions in addition to increasing production also can maintain the stability of crop production, since the system is down during this leads to disrupt the stability of the plant. This is in accordance with Junaidi and Kuswanhadi, (1997) which states how the exploitation of rubber made during this is to do with the leads downward (SKB). And by Sivakumaran et al (1985) intercepts in this way tend to be more susceptible tapping grooves result in drought. Leads down to the suspected cause disconnection

between tapping the header field. This resulted in less smooth latex regeneration process, the flow of photosynthate which is the manufacture of latex inhibited. In addition, it leads down to the drainage area will further reduce latex, with the imminent slices tapping into engagement grafting (elephantiasis). This would result in lower plant responses to stimulant.

Tapping and treatment delivery system stimulants tested in this study may increase production but did not cause stress on the plant. It is associated with thiol levels were not significantly different in each month during the study (November and December 2012) either alone or in combination in the treatment of both treatments. Exploitation and administration system stimulants encourage higher production of clones of IRR 42 which has a low metabolism, but does not cause plant stress. Crop conditions are stable and do not exhibit symptoms of stress can be seen from the thiol content was not significantly different and still in the normal range in this study (0.441 mM-0.569 mM), which is in line with Sumarmadji (et al 2006) which states that the thiol levels clones IRR is generally classified as moderate i.e. 0.4-0.9 mM.

Increased production (g / tree / tapping) and the potential for production in this study was supported by the physiological condition of the plant is dry rubber content, sucrose levels and levels of P-inorganic. This is in accordance with Gohet et al (1996) which states that the grouping of clones based on physiological traits related to growth and crop production is very important.

In a study that tested the tapping system that is  $S_0 = 1/2s \text{ d/3.ET } 2.5\%$  (control),  $S_1 = 1/4S \uparrow \text{ d/3.ET } 2.5\%$ ,  $S_2 = 1/4S \uparrow \text{ d/3.ET } 2.5\% \text{ } 1/2S \text{ d/3 } +$ ,  $S_3 = 1/2s \text{ d/3.ET } \uparrow 2.5\%$ , and  $S_4 = 1/2s \uparrow + 1/2S \text{ d/3 d/3.ET.} 2.5\%$  with 2.5% ethephon stimulant application. Every once a month and twice a month at IRR 42 rubber clones with low metabolic properties of the resulting conclusions: Exploitation of the system under test influence the physiological plant conditions, which increase the KKK, sucrose content, lower thiol content results, and raise the PI, but still quite normal and does not cause stress in plants.

Tapping system affects the conditions of production and plant physiology. Tapping system that produces the highest production is  $S_4 (1/2s \uparrow + 1/2S \text{ d/3 d/3.ET.} 2.5\%)$  and lowest in  $S_1 (1/4S \uparrow \text{ d/3.ET } 2.5\%)$ . Highest dry rubber content is  $S_4 (1/2s \uparrow + 1/2S \text{ d/3 d/3.ET.} 2.5\%)$  and lowest in  $S_1 (1/4S \uparrow \text{ d/3.ET } 2.5\%)$ ; Highest thiol levels  $S_1 (1/4S \uparrow \text{ d/3.ET } 2.5\%)$  and lowest in  $S_4 (1/2s \uparrow + 1/2S \text{ d/3 d/3.ET.} 2.5\%)$ ; levels of sucrose and the highest levels of PI is  $S_4 (1 / \uparrow 2S + 1/2S \text{ d/3 d/3.ET.} 2.5\%)$  and lowest in  $S_1 (1/4S \uparrow \text{ d/3.ET } 2.5\%)$

## Conclusions

Stimulant effect on the production system and the condition of plant physiology. Tapping system that produces the highest production is W2 (2 times a month) and lowest in W1 (1 time a month). Highest dry rubber content is W2 (2 times a month) and lowest in W1 (1 time a month); highest levels of thiol is W1 (1 time a month) and lowest in W2 (2 times a month); levels of sucrose and the highest levels of PI is W2 (2 times a month) and lowest in W1 (1 time a month).

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