

# **Production optimization of clones slow starter IRR 42 application through stimulant etefon**

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**Abstract.** IRR 42 clones belonging to clone a slow starter who has good growth and great girth, but production of the rubber tends to be low when compared to other superior clones. This study aims to obtain stimulant treatment may be able to optimize the production potential clones IRR 42. The research was conducted at the Research Institute for Experimental Sungei Putih, Rubber Research Center for four months (May-August 2012) in the area of crop planting clones IRR 42 years in 2006 (6 years old plants). The treatments tested include concentration of stimulant (S) consisting of 1.25%, 2.50%, 3.50% and 4.50%, treatment application interval (W) consists of one and two times per month as well as application control treatment (without stimulants). The results showed an average production of 2.50% on stimulant treatment and 4.50% at intervals of twice per month ( $S_2W_2$  and  $S_4W_2$ ) have higher production compared with other treatments. In general, plant physiology is still below the threshold.  $S_2W_2$  treatment is the best treatment to optimize the potential of the plant because it has high production but showed lower stress than the exploitation  $S_4W_2$ . Further research is needed in a longer period of time to determine plant responses to each treatment

**Key words:** *Hevea brasiliensis, clone IRR 42, stimulants, production, rubber*

## **Introduction**

Indonesia is a country with the world's largest rubber plantation, which is 3.4 million hectares, but the average level of productivity of rubber Indonesia is still low compared with countries other producers of natural rubber. Indonesia per year production reached 2.4 million tons, while Thailand as one of the producers of natural rubber reached 3.1 million tons per year. The low rubber production in Indonesia mainly due to superior clones is still not optimal adopted by jungle rubber, there are still many who use planting materials from seeds (seedlings). In addition, the quality of the application intercepts and exploitation system as recommended so that result Dry Flow Tapping (CASH).

IRR 42 clones belonging to clone a slow starter who has good growth and great girth, but production of the rubber tends to be low when compared to other superior clones. The use of stimulants is expected to optimize the production potential IRR of 42 clones with more intensive supervision. This is because the risk of uncontrolled use of stimulants can lead to decreased stamina and increase crop intensity CASH.

Stimulant commonly used in the rubber plantation is etefon because the effect is quite effective in increasing the production of rubber. Increase in ethylene production due to compounds that can stabilize the latex and lotuid osmotic pressure so as to delay the

occurrence of coagulation. Lotuid a fraction containing latex base cations. If lotuid broke these cations will react with the rubber particles are negatively charged, causing coagulation (Arokiaraj and Yeang, 2006). The role of ethylene can lower oDPO oxidase activity and increased turgor pressure and phosphorus content results in latex. Therefore ethylene vessel blockage can delay and prolong the flow of latex latex. (Rajagopal. et al., 2004). This study aimed to determine the effect of concentration and application interval and stamina stimulant to the production of rubber clones IRR 42.

### **Materials and Methods**

The research was conducted at the Rubber Research Institute of Experimental Sungei White, Rubber Research Center, located in the district of Deli Serdang - Sumatra with a height of 25 m above sea level and type of Ultisol. The research lasted for four months (May-August 2012) in the area of crop planting clones IRR 42 years in 2006 (6 years old plants). Activity measurements Dry Rubber Content (KKK) and diagnosis analysis Latex (DL) performed at the Laboratory of Physiology Research Centre Sungei White.

The research is based on randomized block design (RBD) with two treatments, namely the concentration of stimulant (S) consists of four levels and stimulant application interval (W) comprising two levels as well as the control treatment (without stimulants). The treatments tested were as follows:

- Control : without giving stimulants
- S<sub>1</sub>W<sub>1</sub> : etefon 1.25% one time per month
- S<sub>2</sub>W<sub>1</sub> : etefon 2.50% one time per month
- S<sub>3</sub>W<sub>1</sub> : etefon 3.50% one time per month
- S<sub>4</sub>W<sub>1</sub> : etefon 4.50% one time per month
- S<sub>1</sub>W<sub>2</sub> : etefon 1.25% twice per month
- S<sub>2</sub>W<sub>2</sub> : etefon 2.50% twice per month
- S<sub>3</sub>W<sub>2</sub> : etefon 3.50% twice per month
- S<sub>4</sub>W<sub>2</sub> : etefon 4.50% twice per month

Each treatment was repeated three times using ten trees each experimental unit. Parameters observed in this study include plant productivity (g / p / s and kg<sup>-1</sup>ha<sup>-1</sup>yr<sup>-1</sup>) and physiological plant include Dry Rubber Content (KKK) and Diagnosis Latex (sucrose concentration, inorganic phosphate and thiol).

### **Results and Discussion**

#### **Plant Productivity**

Based on observations during the four months (May-August 2012) note that in general the treatment of stimulant production applications is higher than the control (without stimulant). Highest production was obtained at treatment S<sub>4</sub>W<sub>2</sub> (28.50 g / p / s) while the lowest production in the control treatment (without stimulants) of 9.64g<sup>-1</sup>p<sup>-1</sup>s<sup>-1</sup>. In general, the treatment of stimulant applications, production is higher than the control (without stimulant). Obtained the highest production potential in the treatment of S<sub>4</sub>W<sub>2</sub> (2507.8 kg<sup>-1</sup>ha<sup>-1</sup>yr<sup>-1</sup>) while the lowest was in the control treatment (847.9 kg<sup>-1</sup>ha<sup>-1</sup>yr<sup>-1</sup>) (Table 1).

Table 1. Rubber production ( $\text{g}^{-1}\text{p}^{-1}\text{s}^{-1}$ ) in each treatment

Treatment	Rubber Production ( $\text{g}^{-1}\text{p}^{-1}\text{s}^{-1}$ )					Potential production ( $\text{kg}^{-1}\text{ha}^{-1}\text{yr}^{-1}$ ) *
	Mei	Juni	Juli	Agustus	Rata-rata	
Kontrol	5,40 d	7,98 e	12,44 d	12,72 b	9,64	847.88
S <sub>1</sub> W <sub>1</sub>	15,32 c	17,27 d	17,83 c	13,03 b	15,86	1,395.90
S <sub>1</sub> W <sub>2</sub>	14,60 c	22,02 cd	24,45 ab	22,75 a	20,96	1,844.04
S <sub>2</sub> W <sub>1</sub>	21,59 ab	19,94 cd	18,89 bc	11,50 b	17,98	1,582.24
<b>S<sub>2</sub>W<sub>2</sub></b>	<b>24,51 ab</b>	<b>28,09 ab</b>	<b>24,20 abc</b>	<b>25,88 a</b>	<b>25,67</b>	<b>2,258.96</b>
S <sub>3</sub> W <sub>1</sub>	22,96 ab	25,23 bc	22,18 abc	13,85 b	21,06	1,852.84
S <sub>3</sub> W <sub>2</sub>	21,96 ab	25,49 bc	23,93 abc	24,54 a	24,00	2,111.71
S <sub>4</sub> W <sub>1</sub>	20,96 b	26,51 bc	20,65 abc	11,53 b	19,91	1,752.30
<b>S<sub>4</sub>W<sub>2</sub></b>	<b>26,51 a</b>	<b>33,74 a</b>	<b>25,58 a</b>	<b>28,16 a</b>	<b>28,50</b>	<b>2,507.78</b>

Note: - The figures followed by the same letter in the same column indicates no significant different in Duncan's test with level of P0.05.

- \* Potential production is calculated assuming a population of 800 ph / ha (spacing of 5.0 x 2.5 m) and the effective tapping 110 hr / yr.

Increased concentration and application interval stimulants tend to increase rubber production, at the same concentration applications twice a month have higher production than once a month application. Stimulants etefon a generator for ethylene can induce the expression of certain proteins in rubber, then protein induces a chain reaction that leads to the increased production of latex form (Obouayeba et al., 2009). Ethylene either endogenous or exogenous inducer act as physiological changes in the cells but the latex vessels. Etepon treatment delays resulting latex clumping actually increase protein expression.

Etefon the active ingredient C<sub>2</sub>H<sub>4</sub> (2-choloro ethyl posphonic acid) will be hydrolyzed in plant tissues produce ethylene gas, ethylene off in network phloem through the process of hydraulic, ethylene worked stimulated proton pump H<sup>+</sup> / Sucrose which enable transport sugar into the cells of latex vessels, ethylene activates ATPase proton pumps and Pase causing acidification and serum lotuid basifikasi cytosol. The role of stimulant use latex vessels thus delaying clotting time longer latex flow. (Anonymousa. 2011). Average rubber

production in May, June, July and August shows that treatment S<sub>2</sub>W<sub>2</sub> and S<sub>4</sub>W<sub>2</sub> have produksi higher compared to other treatments and the potential applied to optimize the potential of the plant. Nevertheless these observations need to be corroborated with observations physiological parameters. The production potential of these two treatments also showed a higher value than other treatments.

### Plant Physiology

Exploitation systems including applications in physiological stimulants put pressure on crops, observations of the KKK and plant physiological parameters through the DL system is intended to determine the effect of the exploitation of plant health and susceptibility to CASH.

Table 2. DL analysis results in each treatment

Treatment	KKK	Sucrose	Fa	Tiol
	%	..... mM .....		
Kontrol	54.24	3.93	5.78	0.35
S <sub>1</sub> W <sub>1</sub>	49.77	4.16	5.63	0.42
S <sub>1</sub> W <sub>2</sub>	53.49	4.13	6.62	0.61
S <sub>2</sub> W <sub>1</sub>	47.75	4.05	6.31	0.52
S <sub>2</sub> W <sub>2</sub>	53.06	4.53	6.13	0.53
S <sub>3</sub> W <sub>1</sub>	52.80	4.03	6.24	0.48
S <sub>3</sub> W <sub>2</sub>	52.11	4.71	6.49	0.63
S <sub>4</sub> W <sub>1</sub>	51.97	4.14	6.64	0.58
S <sub>4</sub> W <sub>2</sub>	52.86	4.63	6.64	0.54

Decrease in plant physiological conditions can be determined by observing the dry rubber content (KKK) and the diagnosis of latex. In the event of severe stress exploitation, the KKK would decrease drastically (Sainoi and Sdoode, 2012). In general there are no significant differences between treatment KKK etefon with controls on the range of 47.75% - 54.24%. Observations for three months showed stimulant concentration of 1.25% - 4.50% with once a month and twice a month does not cause a drastic decline in plant health and are within normal limits. According Gohet *et al.* (2003) showed KKK balance between tapping latex regeneration, KKK low frequency intercepts indicate too high so it does not give enough time for the plants to do the synthesis of latex that has been harvested.

Sucrose content of latex is closely related to the level of exploitation (Junaidi *et al.*, 2010). Based on observations of latex sucrose content ranged from 3.93 to 4.71 mM. Sucrose levels in stimulant treatment was higher than the control treatment, allegedly in response to the plant increased tapping intensity. Latex mass out more so it must be replaced with sucrose levels of photosynthesis so high sucrose in latex networks. This is in support of an indication that in the control treatment, while the lowest levels of sucrose in the treatment of severe (stimulant twice per month) sucrose levels tend to be high.

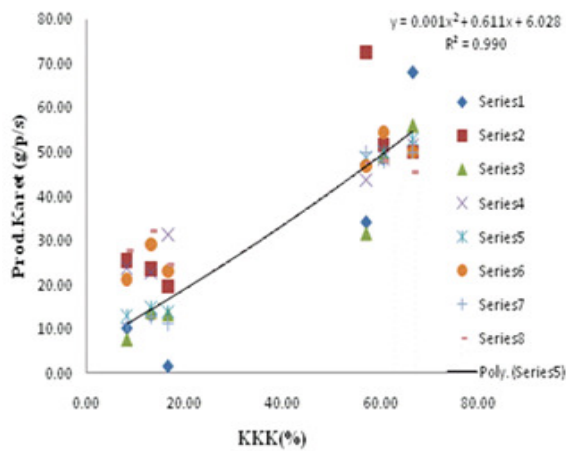
Kuswanhandi *et al.* (2009) stated that high levels of Fa showed high metabolic activity, and vice versa, crop production is generally higher with higher levels of Pi in latex. According to Traore *et al.*, (2011), Fa maximum levels for healthy plant is 25 mM, when Fa levels exceed the threshold then it indicates a plant responses to stress or disease. The results showed that the levels of each treatment Fa still below the threshold in the range of 5.63 to 6.64 mM.

Thiol levels is an important indication of the rubber plant associated with the incidence of CASH (Rajagopal *et al.*, 2004). The higher the intensity of exploitation, the lower the levels of thiols (Krishnakumar *et al.*, 2003). The results showed generally low levels of thiol 0.35 to 0.63 mM (Table 2). S<sub>2</sub>W<sub>2</sub> treatment has pretty high production is only lower than that of S<sub>4</sub>W<sub>2</sub> but has a lower thiol levels so that it can be concluded S<sub>2</sub>W<sub>2</sub> treatment is the best treatment of all treatments tested in this study.

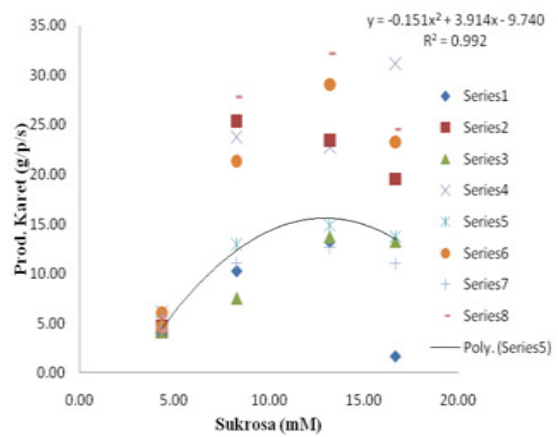
### **Physiology Parameter Relationships with Rubber Production**

Results of regression analysis-correlation ( $R^2$ ) between the KKK, sucrose levels, levels of Fa and thiol levels on the production of rubber in a row is 0.99; 0.99; 0.84 and 0.99 (Figure 1). The high value of  $R^2$  between physiological parameters and production suggests that increasing the intensity of tapping through the application of stimulants greatly affect the physiological condition of the plant. Other factors such as environmental influences are not significant.

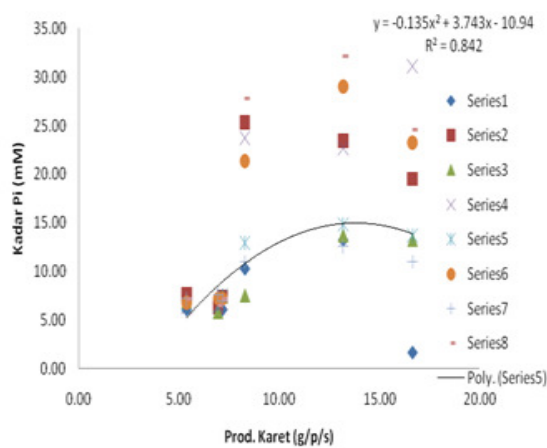
Relationship between the levels of sucrose and rubber production very closely. Under normal conditions of exploitation intensity, the higher the levels of sucrose rubber production potential will increase. But if it keeps going eksploitasi intensity decreased sucrose levels for raw materials depleted or can be increased in response to changing latex issued. The relationship between the levels of production of shaped rubber Fa quadratic equation, which means that increasing the Fa, then the rubber production will also increase. Likewise thiol levels showed a relationship suggests a close relationship with the resulting production.



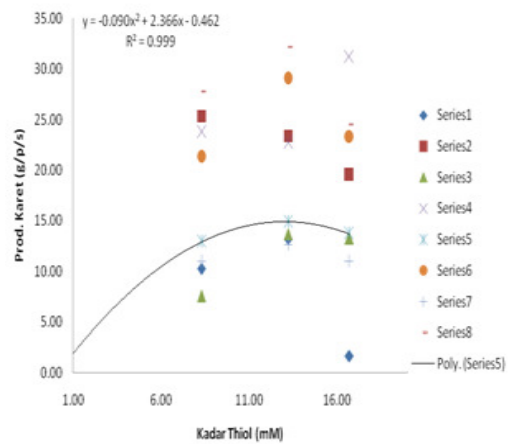
A



B



C



D

Figure1. A. Relations rubber production ( $\text{g}^{-1}\text{p}^{-1}\text{s}^{-1}$ ) to the KKK (%)  
 B. Relations rubber production ( $\text{g}^{-1}\text{p}^{-1}\text{s}^{-1}$ ) on levels of sucrose (mM)  
 C. Relations rubber production ( $\text{g}^{-1}\text{p}^{-1}\text{s}^{-1}$ ) on levels of Fa (mM)  
 D. Relations rubber production ( $\text{g}^{-1}\text{p}^{-1}\text{s}^{-1}$ ) to the thiol concentration (mM).

## Conclusion

From the observation during the four months of the study it can be concluded that the use of stimulants can increase crop production etefon IRR 42 clones, treatment with the potential to increase production is  $\text{S}_2\text{W}_2$  and  $\text{S}_4\text{W}_2$ . Effect of application interval is greater than the concentration of stimulant. In general, plant physiology is still below the threshold.  $\text{S}_2\text{W}_2$  treatment is the best treatment to optimize the potential of the plant because it has

high production but showed lower stress than the exploitation S<sub>4</sub>W<sub>2</sub>. Further research is needed in a longer period of time to determine plant responses to each treatment.

## References

- Anonymous<sup>a</sup>. 2011. Penggunaan Stimulan Gas Pada Tanaman Karet. <http://www.yousaytoo.com/penggunaan-stimulan-gas-pada-tanaman-karet>. diakses pada tanggal 02 Januari 2012.
- Arokiaraj P. and Yeang H.Y., 2006. Yield stimulation of the rubber tree (RRIM 600) with Ethepon does not increase latex hev b 6 protein or m RNA *Rubb. Res. Inst of malaysia*. 9(1) 61-71 8.
- Gohet, E., Chantuma,P., Lacote, R., Obouayeba, S., Dian, K., Clement-Demange, A., Dadan Kurnia and Eschbach, J.M. (2003) Latex Clonal Typology of Hevea barisiliensis: Physiological Modelling of yield potential and clonal response to Ethepon Stimulation. Workshop on Rubber Exploitation Technology. Cottayam india. 14p.
- Junaidi. Sumarmadji. Dan Atmaningsih. 2010. Pengujian Sistem Eksploitasi EXPEX-315 Pada klon PB 260. *J. Penelitian Karet*, 28 (2),41-55.
- Krishnakumar, R., Molly Thomas, Sobhana, p and James Jacob (2003) Tapping panel dryness syndrome Areview. Proc. IRRDB Int. Workshop on Exploitation Technology, *Rubb. Res. Inst. India*.pp 166-178.
- Kuswanhadi, sumarmadji, Karyudi dan T.H.S. Siregar 2009. Optimasi produksi klon Karet melalui Sistem Eksploitasi Berdasarkan metabolisme lateks. Prosiding lokakarya Nasional Pemuliaan tanaman karet 2009.
- Obouayeba, S., Soumahin EF, Dobo M, Lacote R, Gabla O, and Doumbia A,(2009) . Agronomic Performance of the Clone IRCA 111 of Hevea brasiliensis under Different Frequencies of tapping and Stimulation in South-west Cote d'Ivoire.
- Rajagopal, R., Vijayakumar KR, Thomas KU, Karunaichamy K (2004). Effect ofjudicious Ethepon Aplication on yield Response of *Hevea brasiliensis* (clone RRII 105) under 1/2Sd/36d/7 tapping system. *J Rubb. Res*. 7(2): 138-147.
- Sainoi T and Sdoodee, S. (2012) The impact of ethylene gas application on young-tapping rubber trees. *Journal of Agricultural Technology* 2012 Vol. 8(4): 1497 – 1507.
- Traore, M.S., Diarrasouba M., Okoma K.M., Dick K.E., Soumahin E.F., Coulibaly L.F., Obouayeba, S. (2011). Long-term effect of different annual frequencies of ethylene stimulation On rubber productivity of clone GT 1of *Hevea brasiliensis* (Muell. Arg.) in South East of Cote d'Ivoire.*Agriculture and Biology Journal of North America* 2:1251-1260.