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Alternative Tapping Systems for RRIC 100 Clone from Opening

Eva Herlinawati and Kuswanhadi

Sembawa Research Centre, Indonesian Rubber Research Institute, Palembang 30001, Indonesia

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Abstract: Ethephon or gas stimulation application is a common practice in rubber cultivation especially in commercial estates. The use of stimulation can be combined with reduction in the intensity of tapping by reducting of cut length. The purpose of this study was to compare and to evaluate the effect of various tapping systems on production and physiology characters from opening. The experiment was carried out in the experimental field of Sembawa Research Centre since March until December 2011. The experimental design was the Completely Randomized Block Design with 6 treatments and 8 replication. The experiment used RRIC 100 clone planted in 2004. The treatments were S/2 d3, S/2 d3 ET2.5% Ga1 12/y (m), S/2 d3 ET2.5% Ga1 24/y (2w), Sc20 U d3 ETG 12/y(m), Sc20 U d3 ETG 24/y(m), and Sc20 U d3 ET2.5% Ba1 24/y(2w). The results showed that the tapping system of S/2 d3 ET2.5% Ga1 12/y (m) or Sc20 U d3 ETG 12/y(m) can increase production without negative effect on physiology parameters. However, application of gas stimulation on young trees should be used with consideration for the risk of tapping panel dryness. Since the upward tapping tends to result in a thicker cut and latex spillage from the groove, the tapper should be well trained.

Key words: Tapping system, RRIC 100, opening, ethylene, ethephon, short tapping, gas stimulation.

1. Introduction

The serious problem in rubber cultivation is shortage of labour having good skill in latex harvesting and high cost of tapping labour. This situation encourages the rising of cost production per unit area. Therefore, improving efficiency of exploitation system is an effort to optimize profit. One way to improve efficiency is stimulant application i.e., ethephon or ethylene gas. Stimulant application can increase latex yield by increasing the duration of latex flow due to delay in plug formation of latex vessel [1-4]. The destabilizing activity of lutoid serum was considerably reduced by stimulation [5]. It can affect latex cell metabolism, which appears from the physiology characters i.e., sucrose, inorganic phosphorus, thiol, and total solid contents (TSC) [6, 7].

A common practice of exploitation in rubber plant is the combination half spiral cut tapped downward with stimulation. Refs. [8, 9] reported that downward tapping restricted the assimilate flow to the drainage area. This may inhibit material supply for rubber regeneration that cause the yield to be lower. Further, the limitation in drainage area occurs when the cut approaches the onion. In addition, downward tapping tends to result incidence of tapping panel dryness.

Based on this evidence, an idea comes up to change tapping direction from downward to upward since opening. Upward tapping on GT 1 and RRIM 600 clones could increase the yield until 54% in the first tapping year [8]. Whereas, Ref. [10] reported that upward tapping on GT 1 clone improved the yield about 34%-46% above the downward tapping. Ref. [11] defined that the response clones on upward tapping are different. By this system, the relation between tapping panel and crown was constantly maintained so that panel blockage could be avoided and assimilate could flow effectively [6]. In addition, the latex flow would

Corresponding author: Eva Herlinawati, M.Sc., research field: latex harvesting. E-mail: Eva_herlinawati@yahoo.com.

be improved by the gravity [9].

The implementation of upward tapping should be followed by stimulant application and reduction of tapping cut length. The reduction of tapping cut length permits to manage better the tapping panel, to improve the productivity of the tapper and to increase the economical life span of rubber trees [12]. In addition, for a short tapping cut, turgor pressures and hence pressure gradients along the vessels should be better maintained than those with a long tapping cut [13].

The purpose of this study was to compare and to evaluate the effect of alternative tapping systems from opening. The study analyzed both the relationship between latex yield in different tapping system and physiology parameters in latex cell. Optimum tapping system will be the one that gives highest yield without causing disturbances in the latex cells.

2. Materials and Methods

The experiment was carried out in the experimental field of Sembawa Research Centre since March 2011 until December 2011. The experimental design was the Completely Randomized Block Design with 6 treatments and 8 replicates. The experiment used RRIC 100 clone planted in 2004. Details of treatments is given in Fig. 1:

(1) S/2 d3 (half spiral cut, tapped downward every 3 days);

(2) S/2 d3 ET2.5% Ga1 12/y (m) (half spiral cut, tapped downward every 3 days with ethephon stimulation of 2.5% active ingredient, application 1 g/tree on groove, twelve times per year at monthly interval);

(3) S/2 d3 ET2.5% Ga1 24/y (2w) (half spiral cut, tapped downward every 3 days with ethephon stimulation of 2.5% active ingredient, application 1 g/tree on groove, twenty-four times per year at fortnightly interval);

(4) Sc20 U d3 ETG 12/y(m) (small cut of 20 cm, tapped upward every 3 days with ethylene gas stimulation, twelve times per year at monthly interval);

(5) Sc20 U d3 ETG 24/y(m) (small cut of 20 cm, tapped upward every 3 days with ethylene gas stimulation, twenty-four times per year at fortnightly interval);

(6) Sc20 U d3 ET2.5% Ba1 24/y(2w) (small cut of 20 cm, tapped upward every 3 days with ethephon stimulation of 2.5% active ingredient, application 1 g/tree on bark, twenty-four times per year at fortnightly interval).

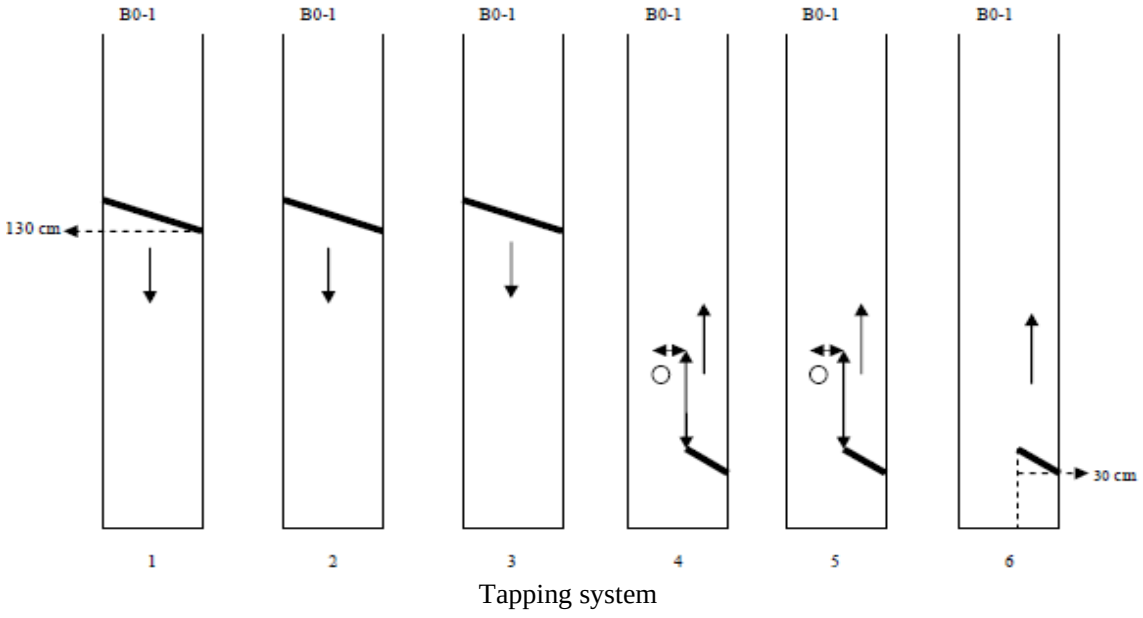

Fig. 1 Position of tapping cut with different tapping systems (o = gas applicator).

Gas stimulation was applied in each tree (treatment 4 and 5), that is, panel was divided into 4 parts. Gas applicator was applied 20-30 cm above tapped panel and 5-7 cm to the left. The gaseous method of stimulation involves application of pulse of ethylene gas with the aid of a detachable one way valve through a plastic tubing into a bag before absorbed by trees.

The production was measured by weighing the cup lump from each tree every 3 days. Total solid content was measured with gravimetric method, based on ratio between dry matter and fresh matter from 5 gram of latex. Latex drying was conducted at 100 ºC until constant weight was reached. The latex physiology parameters i.e., sucrose and inorganic phosphorous, were measured every 3 months. The sucrose and the inorganic phosphorous were measured on the clear serum called Tricloroacetic acid (TCA) serum after latex acid coagulation, with the anthrone method [14], and the molybdate ammonium method [15], respectively.

The observation of dry cut length was done by visual estimation, then the percentage was converted to value score.

3. Results and Discussion

The use of ethephon stimulation in conventional tapping system (S/2 ET2.5%) increased yield about 146.2%-165.2% (treatments 2 and 3) compared treatment 1 (control) (Fig. 2). However, increasing frequency of ethephon stimulation from once a month to twice a month did not improve yield anymore. While the combination small cut upward tapping with gas stimulation rose yield slightly about 154.3%-165.8% (treatment 4 and 5), but the combination small cut upward tapping with ethephon stimulation only increased about 123.9% (treatment 6).

The results showed that by reducing of tapping cut length from half spiral to small cut 20 cm and by changing of tapping direction from downward to upward, the yield was relatively similar as half spiral downward tapping. There was an opportunity that small cut was possible to save bark consumption without declining yield and extending the economic life span of rubber trees. In contrast, the combination small cut upward tapping with ethephon stimulation had poorer yield than the combination small cut upward tapping with gas stimulation. This condition indicated the combination small cut upward tapping was preferable with gas stimulation.

Both the combination half spiral with ethephon stimulation and the combination small cut upward tapping with ethephon or gas stimulation increased yield by the prolongation of latex flow. It is due to stabilizing activity of lutoid serum which delay in plug formation of latex vessel. One parameter that was closely related to latex flow was total solid content [1-3, 5]. Both the total solid content and the production had a negative correlation meaning that higher latex production would be followed by decreasing of total solid content (Fig. 5a). It is similar to the result of research by [16]. Total solid content in ethephon or gas stimulation treatments declined with different level (Fig. 3). Even though, it was still normal (above 30%) reflecting the adequate regeneration of latex [1]. Stimulation can reduce the disturb flow through the dilution reaction of latex. The mechanism of a certain dilution of latex was by reducing the viscosity and thus increased fluidity. In

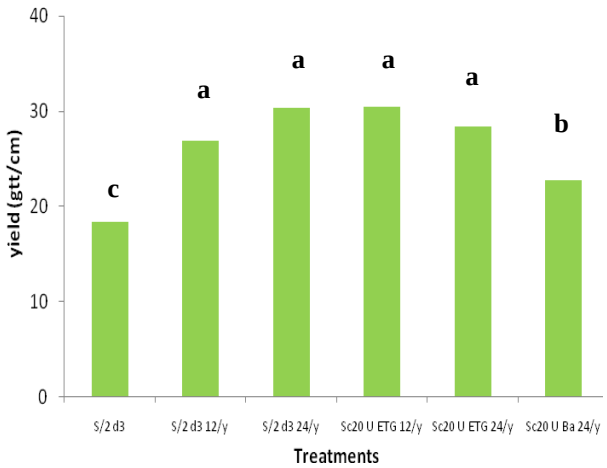

Fig. 2 Yield with different tapping systems.
Values followed by the same letter in the same column, are not significantly different at 5%.

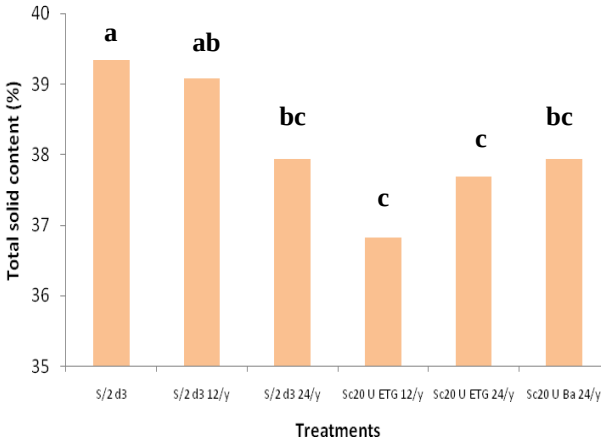

Fig. 3 Total solid content with different tapping systems.
Values followed by the same letter in the same column, are not significantly different at 5%

addition, it could extend progressively along the laticiferous vessels [17].

Whereas, the effect of latex regeneration would be reflected on inorganic phosphorous and sucrose. In general, the treatment of half spiral with ethephon stimulation and the combination of small cut upward tapping with ethephon or gas stimulation increased inorganic phosphorus (Fig. 4). Increasing inorganic phosphorous showed that increasing of metabolism activity in latex cell [1, 18]. The relationship between inorganic phosphorous and production was positive correlation (Fig. 5c), but inorganic phosporous and sucrose was negative correlation (Fig. 5b). In addition, the relationship between yield and sucrose was also negative coorelation (Fig. 5d). It meant that increasing metabolism activity would be followed by increasing sucrose consumption [7]. Increasing frequency of ethephon stimulation from once a month to twice a month did not increase production of latex and inorganic phosporous, but decreasing of sucrose content until 4 mM level. It showed that the reserve sucrose on tapping panel was still low and the reserve sucrose from phloem was not sufficient [6]. Likewise, the increasing frequency of gas stimulation from once a month to twice a month did not increase inorganic phosporous, sucrose, and production of latex.

Over exploitation in rubber tree will trigger arising of dry cut length. The effect of treatments should be considered on dry cut length. Intensity of dry cut length in the combination small cut upward tapping with gas stimulation was higher than the combination small cut upward tapping with ethephon stimulation, having category 1, it showed that the intensity of dry cut length was still relatively low (< 25%) (Table 1). The using of gas stimulation in the long term should be used with consideration to prevent from metabolic disturbance in the latex biosynthesis. In such condition, gas stimulation might result in exhaustion of latex vessel [3, 19].

Although small cut upward tapping produced higher latex production, but the some common problems, such as poor of tapping quality and loss of production, were still faced by this tapping system. Bark consumption for small cut upward tapping was more thicker than half spiral downward tapping. This condition was associated with more difficult control of the tapping. The skill of upward tapper was still lower than the skill of downward tapper. The effort to overcome the problem was to train tappers intensively and continuosly to increase their skill especially on the thickness of tapping cut. Likewise, the latex flow was often latex spillage by this tapping system (Fig. 6b). It has been attributed crop loss production [20].

4. Conclusions

Alternative tapping system found in this experiment

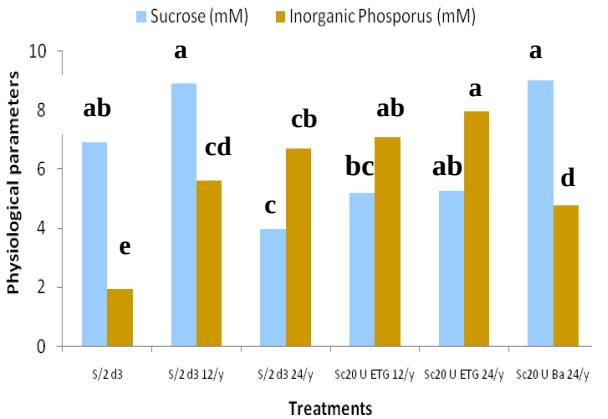

Fig. 4 Some physiological parameters with different tapping systems.
Values followed by the same letter in the same column, are not significantly different at 5%.

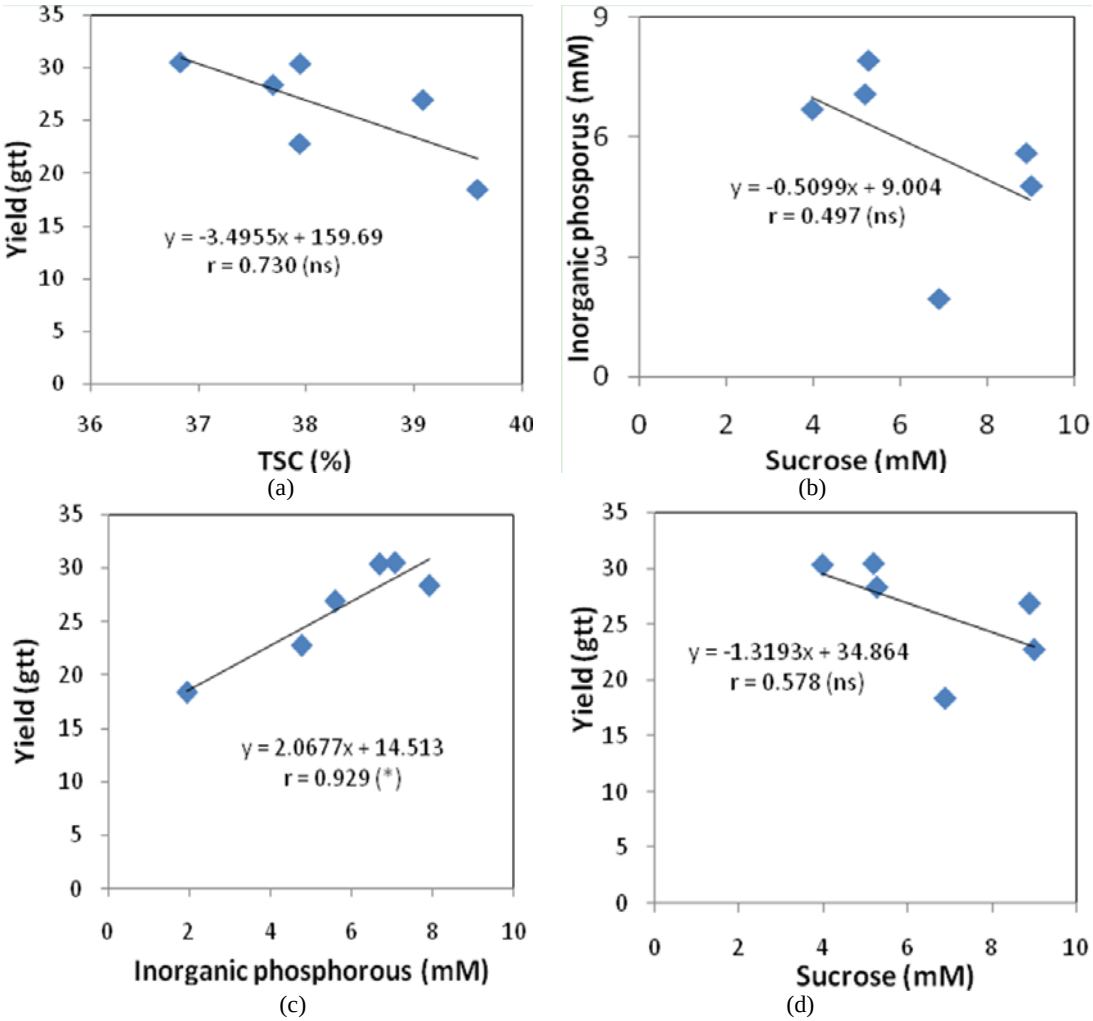

Fig. 5 The relations between some physiological parameters of latex and yield. (a) Yield and TSC; (b) Inorganic Phosporus and sucrose; (c) Yield and inorganic phosphorus; (d) Yield and sucrose.

(* = significant, ns= not significant).

Table 1 Score of tapping panel dryness.

Score	Tapping panel condition
0	Healthy cut
1	1-25% dry cut
2	26-50% dry cut
3	51-75% dry cut
4	76-100% dry cut

Table 2 Categories of dry cut length in different tapping systems.

Treatments	Tapping panel dryness
S/2 d3 (control)	0
S/2 d3 ET2.5% Ga1 12/y	0
S/2 d3 ET2.5% Ga1 24/y	0
Sc20 U d3 ETG 12/y	1
Sc20 U d3 ETG 24/y	1
Sc20 U d3 ET Ba1 24/y	0

Tapping panel dryness categories: 0% = 0; 1-25% = 1; 26-50% = 2; 51-75% = 3; 76-100% = 4.

Fig. 6 Some problems in upward tapping. (A) The comparison of bark consumption from two tapping systems; (B) Latex spillage from the groove.

are S/2 d3 ET2.5% Ga1 12/y (m) or Sc20 U d3 ETG 12/y(m) which increase production without negative effect on physiology parameters. However, application of gas stimulation on young trees should be used with consideration for the risk of tapping panel dryness. Since the upward tapping tends to result in a thicker cut and latex spillage from the groove, the tapper should be well trained.

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