# The Effect of Ethrel Stimulation on Tapping Panel Dryness of *Hevea brasiliensis*

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## ABSTRACT

**Tapping panel dryness (TPD) is a physiological disorder found in *Hevea brasiliensis* (rubber) trees. This study attempts to investigate relationship between ethrel stimulation and incidence of TPD. In a mature RRIC 102 (a d/2 clone) field, three stimulated and three unstimulated tapping blocks were selected for the study. Further, three unstimulated tapping blocks were selected randomly from RRIC 130 (a d/3 clone). RRIC 102 and RRIC 130 fields selected for the study had been tapped for 48 and 60 months respectively. Total trees and all TPD trees in the tapping blocks selected for the study were counted and percentage incidence of TPD was determined separately for each block. The total bark consumption was measured separately for all TPD affected and in ten randomly selected healthy trees in each block. Latex volume and the metrolac reading were measured for three consecutive tapping days from each block to determine the total dry rubber yield. Further, relationship between stimulation and TPD was analyzed using average values. In RRIC 102, stimulated tapping blocks showed a higher TPD% than in non-stimulated tapping blocks. Grams per tree per tapping (g/t/t) was high in RRIC 102 stimulated tapping blocks. The average number of tappings for the onset of TPD showed a higher value in stimulated blocks. Clone RRIC 130 showed a higher value in average g/t/t and average number of tappings for the onset of TPD. But it showed lower value in average TPD% than in non-stimulated RRIC 102 trees. Hence, it could be concluded that there is a relationship between ethrel stimulation and TPD, but further studies are needed to confirm the results. Further, it is apparent that trees are more susceptible for TPD when tapped in the mid region of the base panels.**

**KEYWORDS:** Clone, Ethrel stimulation, *Hevea brasiliensis*, Tapping panel dryness

## INTRODUCTION

Rubber (*Hevea brasiliensis* L.) is the main source of natural rubber and it is an economically important plantation crop in Sri Lanka. Natural rubber is an important industrial crop both nationally and globally. The commercial planting of rubber in Sri Lanka was commenced in 1883 (Wastie, 1986). It provides socio-economic and environmental benefits and today rubber plantation industry plays a significant role in our economy (Jayasinghe, 2010).

Rubber is a forest tree and it is native to the Amazon forest in North America. Rubber plant was first introduced to Sri Lanka by Sir Henry Wickham in 1876 *via* Kew Gardens in England. From Sri Lanka, the rubber plant was introduced to the other Asian countries. World natural rubber production is about 12,267,000 tonnes (Anon, 2015). Sri Lanka produces around 130 million kg of natural rubber annually (Anon, 2013). The rubber extent in Sri Lanka is approximately 133,668 ha (Anon, 2013b). Rubber (cis-1, 4-polyisoprene) is one of the most important naturally produced polymers and it is a strategic raw material used in over 40,000 products, including more than 400 medical appliances (Mooibroek and Cornish, 2000).

Tapping panel dryness (TPD) is a complex physiological syndrome widely found in rubber plantations, resulting in severe crop losses in all natural rubber producing countries. Reduced latex yield leading to total drying of the tapping panel is the symptom of this physiological disorder. This results in 15- 20% loss of annual rubber production in every rubber growing country (Jacob and Krishnakumar, 2006). In TPD affected trees there are also subsequent symptoms such as bark scaling and abnormal growth (Senevirathna *et al.*, 2007). There is no effective treatment for either the prevention or the cure of this serious incidence (Venkatachalam *et al.*, 2006). The actual cause for this disorder is still unknown. However it is widely believed to be due to oxidative stress caused by a range of stress factors (Jacob and Krishnakumar, 2006).

Stimulating of rubber trees using the chemical 2-chloroethylphosphonic acid (Ethephon or Ethrel) has been practiced the objective of enhancing income levels from rubber cultivation by increasing latex harvesting and harvester efficiency (Nugawela, 2006). Ethylene acts on membrane permeability, leading to prolonged latex flow and increased yield (Zhang and Zhu, 2009). However, because of this chemical action the trees get stressed. So, though stimulation can give short term benefits, it can give long term undesirable results as well (Sainoi and Sdoodee, 2012).

In this study, attempts are made to investigate the impact of ethrel stimulation on the incidence of TPD, at their early stage of tapping, by using two clones widely planted by the growers. The outcome of this study will enable to understand some factors related to the incidence of TPD which could help the growers manage this physiological disorder. The trees which were having tapping cuts with more than 90% of the length of the tapping cut not yielding were considered as fully TPD trees.

## MATERIALS AND METHODS

***Location***

Study was carried out at the Sapumalkanda Estate, Dareniyagala, Avissawella during the period from January to April 2016. This area belongs to the wet zone of the country and receives a mean annual rainfall of over 3,500 mm with a temperature ranging from 27 °C to 33 °C.

***Relationship between Stimulation and TPD Incidence***

Two rubber clones (RRIC 102, and RRIC 130) recommended for large scale planting were identified for the study. From RRIC 102 clone, a field that had been tapped for a period of about 48 months was selected. This field had six tapping blocks out of which three were stimulated (tapping system s/2 d/3+E) and other three were not (tapping system s/2 d/3). Three tapping blocks were also identified from clone RRIC 130 and tapped using s/2 d/3 system. This field had been tapped for a period of about 60 months (Table 1).

The fields for the study were selected from one division of the estate to ensure uniformity in soil and other climatic factors that could influence the incidence of TPD.

**Table 1. Details on experimental sites**

| Clones | Group and division | Planted year | Months tapped |
|---|---|---|---|
| RRIC 102 | Sapumalkanda, Galahitikanda | 2005 | 48 |
| RRIC 130 | Sapumalkanda, Galahitikanda | 2004 | 60 |

All healthy and TPD trees were counted in all the tapping blocks selected for the study. Then the % of TPD trees was calculated for every block separately as shown below.

$$TPD\% = (TPD\ trees/Total\ trees) \times 100$$

The total bark consumption was measured separately for all TPD affected trees in each block. From this information the number of tapings undertaken prior to the onset of TPD was estimated for each TPD tree. This was done by dividing the total bark consumption by the thickness of the bark removed per tapping. Although there was a recommended thickness for per day bark consumption (0.125 cm) the actual was calculated using healthy and continuously tapped trees from the first day of tapping. Using ten randomly selected trees of that category the total bark consumption was measured and the average bark consumption of a tree was calculated. The average bark consumption of a tree was divided by the total days a tree had been tapped to get per day bark consumption.

***Relationship between Stimulation and Yield/Tree/Tapping (g/t/t)***

The latex volume and its metrolac reading were measured for three consecutive tappings of each tapping block selected for the study. From that, the total dry rubber yield was estimated for each tapping and the average yield of a tapping block was calculated. The average yield per tree per tapping of a block was calculated by dividing the average total dry rubber yield of a block by the number of total tappable trees in that block. This procedure was repeated for each clone and tapping system used for the study.

***Data Analysis***

Descriptive data analysis was undertaken using MS Office package. Average values were taken using MS Excel and are presented graphically and in tabular form.

## RESULTS AND DISCUSSION

***Relationship between Stimulation and TPD Incidence***

In clone RRIC 102, the average TPD percentage of stimulated blocks (36.6%) was higher than in non-stimulated blocks (19.1%; Figure 1). The average TPD on set time was higher in stimulated blocks (309 days) than in the non-stimulated blocks (277 days; Figure 2). The average g/t/t was higher in stimulated blocks (27.2 g) than in the non-stimulated blocks (19.4 g; Figure 3).

The TPD trees of clone RRIC 102 stimulated and non-stimulated tapping blocks were categorized based on the time taken for the onset of TPD (Figure 4). It is apparent that in both stimulated and unstimulated tapping blocks the incidence of TPD had been highest during the 180$^{th}$ to 480$^{th}$ tapping. Hence it is apparent that a tree is more susceptible for TPD when the tree is tapped in the mid region of the base panels of the trees.

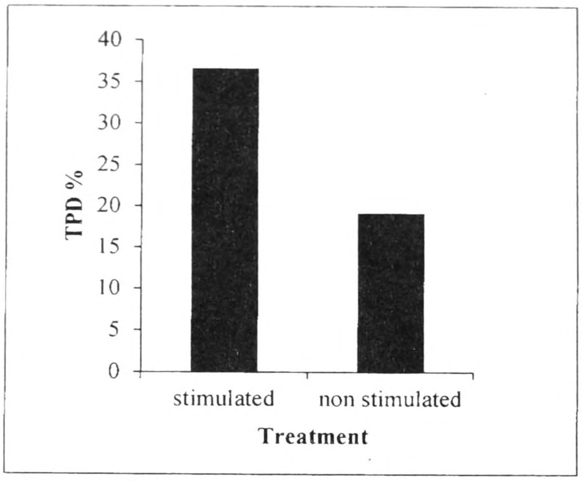


**Figure 1. The average percentage of tapping panel dryness (TPD) trees in stimulated and non-stimulated tapping blocks**

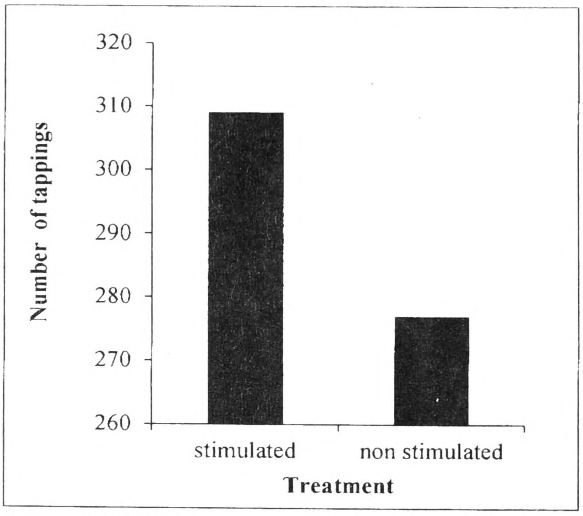


**Figure 2. The average tapping panel dryness (TPD) on set time in stimulated and non-stimulated tapping blocks**

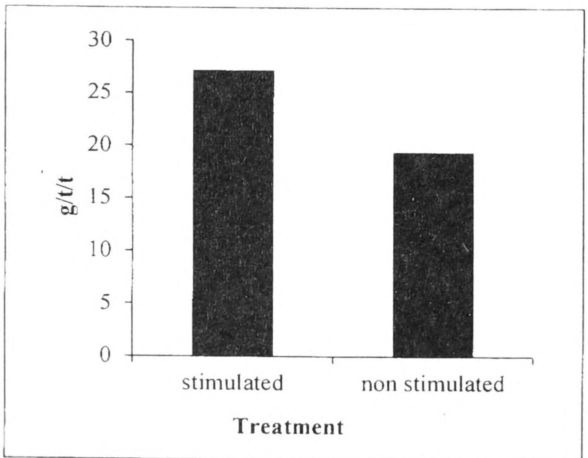


**Figure 3. The average g/t/t value of stimulated and non-stimulated tapping blocks**

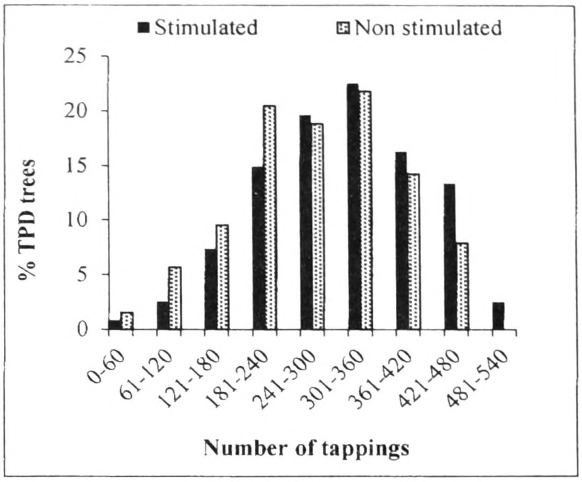


**Figure 4. The relationship between the number of tappings undertaken and the incidence of tapping panel dryness (TPD)**

In clone RRIC 130, the TPD percentage was 17.73% after 60 months of tapping. This is less than in RRIC 102 which recorded 19.06% after a lesser period of tapping, i.e. 48 months (Table 2).

**Table 2. Comparison of percentage tapping panel dryness (TPD) between non stimulated RRIC 102 and RRIC 130 trees**

| Clone | g/t/t | TPD% | TPD on set days |
|---|---|---|---|
| RRIC 102 | 19.40 | 19.06 | 277 |
| RRIC 130 | 24.52 | 17.73 | 406 |

Despite of having a lower percentage of dry trees RRIC 130 showed a higher g/t/t value than in RRIC 102 (Table 2). Hence, it is evident that RRIC 102 is more prone to TPD when comparing with RRIC 130. The study also reveals that high g/t/t is not always correlated with the incidence of TPD. The average number of tappings for the onset of TPD was also high in clone RRIC 130 than in RRIC 102 clone (Table 2). This finding further conforms the fact that RRIC 102 is relatively more prone to TPD than RRIC 130.

## CONCLUSIONS

Since the incidence of TPD was found to be relatively high in stimulated blocks than in the unstimulated blocks of the clone RRIC 102 it is evident that the ethrel stimulation had some influence on incidence of TPD. Stimulation results in a higher yield and hence stimulated trees could be in a relatively higher state of stress condition than the unstimulated trees. However, the fact that onset of TPD was late in the stimulated trees than in the unstimulated trees make the study rather inconclusive. Hence, further studies are recommended to obtain firm results. The fact that RRIC 130 recorded a lower percentage of TPD even with a longer duration of tapping when comparing with unstimulated RRIC 102 reveals that clone RRIC 102 is more susceptible to TPD than RRIC 130. This is despite RRIC 130 been a higher yielding clone than RRIC 102. Further it is apparent that the mid region of the base panels is more susceptible for the incidence of TPD.

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