



UNIVERSITI PUTRA MALAYSIA

**PHYSIOLOGICAL PARAMETERS OF LATEX FROM
CONTROLLED UPWARD TAPPING OF HEVEA
BRASILIENSIS STIMULATED
WITH ETHEPHON**

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PHYSIOLOGICAL PARAMETERS OF LATEX
FROM CONTROLLED UPWARD TAPPING
OF *HEVEA BRASILIENSIS* STIMULATED WITH ETHEPHON

by

NGUYEN ANH NGHIA

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*Thành Quả Đây Xin Được Kính Dâng
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Vì Sự Hy Sinh Lớn Lao Cho Cuộc Đời Tôi*

*This Thesis Is Specially Dedicated To The Memory Of
My Late Beloved Father, Mr. Nguyen Van Suu
Who Passed Away In November 13, 1995
And Also To My Dearest Mother, Mrs. Nguyen Thi Be.
Their Sacrifice And Infinite Love Led Me To Present
Achievements*



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TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iii
LIST OF TABLES	viii
LIST OF FIGURES	xii
LIST OF PLATES	xiv
LIST OF ABBREVIATIONS	xv
ABSTRACT	xvii
ABSTRAK	xx
 CHAPTER	
I INTRODUCTION	1
 II LITERATURE REVIEW	
Latex Exploitation of <i>Hevea brasiliensis</i>	5
The Development of Tapping Systems	5
Upward Tapping of the High Panel	9
Exploitation Notation	14
Latex Yield Stimulation	15
Composition of Latex from <i>Hevea brasiliensis</i> as a Laticiferous Cytoplasm	26
Constituents of Latex	26
The Physiological Parameters of Latex in Relation to Production	30



III	MATERIALS AND METHODS	38
	Experimental Design	38
	Environmental Conditions	39
	Selection of Experimental Trees	40
	Stimulation Practice	40
	Collection and Analysis of Samples	40
	Methodology of Analysing Physiological Parameters	43
	Yield Recording	59
	Tapping Panel Dryness Survey	59
	Statistical Analysis	60
IV	RESULTS	61
	Effect of Ethephon Stimulation on Dry Rubber Yield and Physiological Parameters	61
	Dry Rubber Yield	61
	Total Solid Content (TSC)	65
	Latex pH and Cytosolic pH	67
	Activity of Enzyme Invertase	72
	Bottom Fraction (BF)	77
	Inorganic Phosphorus Content (Pi)	79
	Thiol Content (R-SH)	82
	Sucrose Content	84
	Activity of Enzyme Polyphenol Oxidase	86
	Tapping Panel Dryness	88



Correlation between Parameters	88
Correlation between Yield and Physiological Parameters	88
The Relationship between Physiological Parameters	91
V DISCUSSIONS	94
Effect of Ethephon Stimulation on Dry Rubber Yield and Physiological Parameters of Latex from High Panel Controlled Upward Tapping	94
Interparametric Correlation of Latex from High Panel Controlled Upward Tapping	107
VI SUMMARY AND CONCLUSION	113
BIBLIOGRAPHY	117
APPENDICES	136
A Additional Tables	136
B International Notation for Exploitation Systems	169
VITA	179



LIST OF TABLES

Table		Page
1	Performance of dry rubber yield (gram/tree/tapping) under several ethephon concentrations from January to September 1996	63
2	Means of total solid content (TSC) (%) under several ethephon concentrations from January to September 1996	67
3	Means of latex pH under several ethephon concentrations from January to September 1996	68
4	Means of cytosolic pH under several ethephon concentrations from March to September 1996	69
5	Means of C serum invertase activity under several ethephon concentrations from February to September 1996	73
6	Means of Tx serum invertase activity under several ethephon concentrations from February to September 1996	74
7	Means of bottom fraction (%) under several ethephon concentrations from February to September 1996	77
8	Means of inorganic phosphorus content (mM) under several ethephon concentrations from January to September 1996	80
9	Means of thiol content (mM) under several ethephon concentrations from January to September 1996	82
10	Means of sucrose content (%) under several ethephon concentrations from January to September 1996	84
11	Means of PPO activity under several ethephon concentrations from February to September 1996	86



12	Simple correlation coefficients between yield and other parameters in every month (from March to September 1996) ..	90
13	Significant levels in correlation coefficients between parameters from April to September 1996	93
14	Meteorological data at RRIES from January to September 1996	137
15	Comparison of dry rubber yield (gram/tree/tapping) before and after stimulation on each treatment from March to September 1996	138
16	Comparison of total solid content (TSC) (%) before and after stimulation on each treatment from March to September 1996	139
17	Comparison of latex pH before and after stimulation on each treatment from March to September 1996	140
18	Comparison of cytosolic pH before and after stimulation on each treatment from April to September 1996	141
19	Comparison of C serum invertase activity (units) before and after stimulation on each treatment from March to September 1996	142
20	Comparison of Tx serum invertase activity (units) before and after stimulation on each treatment from March to September 1996	143
21	Comparison of bottom fraction (%) before and after stimulation on each treatment from March to September 1996	144
22	Comparison of inorganic phosphorus content (Pi) (mM) before and after stimulation on each treatment from March to September 1996	145



23	Comparison of thiol content (R-SH) (mM) before and after stimulation on each treatment from March to September 1996	146
24	Comparison of the difference between samplings on thiol content (R-SH) (mM) on each treatment from March to September 1996	147
25	Comparison of sucrose content (mM) before and after stimulation on each treatment from March to September 1996	148
26	Comparison of polyphenol oxidase (PPO) activity before and after stimulation on each treatment from March to September 1996	149
27	Summary of statistical analysis tables on means of dry rubber yield (gram/tree/tapping) in every month (from January to September 1996)	150
28	Summary of statistical analysis tables on means of total solid content (TSC) (%) in every month (from January to September 1996)	151
29	Summary of statistical analysis tables on means of latex pH in every month (from January to September 1996)	152
30	Summary of statistical analysis tables on means of cytosolic pH in every month (from March to September 1996)	153
31	Summary of statistical analysis tables on means of C serum invertase activity (units) in every month (from February to September 1996)	154
32	Summary of statistical analysis tables on means of Tx serum invertase activity (units) in every month (from February to September 1996)	155
33	Summary of statistical analysis tables on means of bottom fraction (%) in every month (from February to September 1996)	156



34	Summary of statistical analysis tables on means of inorganic phosphorus content (Pi) (mM) in every month (from January to September 1996)	157
35	Summary of statistical analysis tables on means of thiol content (R-SH) (mM) in every month (from January to September 1996)	158
36	Summary of statistical analysis tables on means of sucrose content (mM) in every month (from January to September 1996)	159
37	Summary of statistical analysis tables on means of polyphenol oxidase (PPO) activity in every month (from March to September 1996)	160
38	Summary of statistical analysis tables to compare the difference between samplings on thiol content (R-SH) (mM) on each treatment in every month (from March to September 1996)	161
39	Simple correlation coefficients between physiological parameters in April 1996	163
40	Simple correlation coefficients between physiological parameters in May 1996 ..	164
41	Simple correlation coefficients between physiological parameters in June 1996 .	165
42	Simple correlation coefficients between physiological parameters in July 1996 .	166
43	Simple correlation coefficients between physiological parameters in August 1996	167
44	Simple correlation coefficients between physiological parameters in September 1996	168



LIST OF FIGURES

Figure		Page
1	Schematic representation the difference between Controlled Upward Tapping (CUT) and downward tapping of rubber tree ...	10
2	Separation of latex into 'zone' by refrigerated ultracentrifugation (after Moir 1959)	27
3	Variation of dry rubber yield under the effect of several ethephon concentrations over the period of experiment	64
4	Variation of total solid content (TSC) under the effect of several ethephon concentrations over the period of experiment	66
5	Variation of latex pH under the effect of several ethephon concentrations over the period of experiment	70
6	Variation of cytosolic pH under the effect of several ethephon concentrations over the period of experiment	71
7	Variation of C serum invertase activity under the effect of several ethephon concentrations over the period of experiment	75
8	Variation of Tx serum invertase activity under the effect of several ethephon concentrations over the period of experiment	76
9	Variation of bottom fraction under the effect of several ethephon concentrations over the period of experiment	78



10	Variation of Pi content under the effect of several ethephon concentrations over the period of experiment	81
11	Variation of thiol content under the effect of several ethephon concentrations over the period of experiment	83
12	Variation of sucrose content under the effect of several ethephon concentrations over the period of experiment	85
13	Variation of PPO activity under the effect of several ethephon concentrations over the period of experiment	87



LIST OF PLATES

Plate		Page
1	Controlled Upward Tapping (CUT)	11



LIST OF ABBREVIATIONS

a.i.	Active ingredient
ANOVA	Analysis of variance
BF	Bottom fraction
C serum	Cytosolic serum
CUT	Controlled Upward Tapping
DRC	Dry rubber content
DTNB	Dithio- <i>bis</i> -nitrobenzoic acid
EDTA	Ethylenediaminetetraacetic acid
ET	Ethephon
g/t/t	Grams of dry rubber yield per tree per tapping
GLM	General Linear Model
IRCA	Institut de Recherches sur le Caoûtchouc en Afrique
IRCV	Institut de Recherches sur le Caoûtchouc du Vietnam
IRRDB	International Rubber Research Development Board
La	Lace application
LSD	Least Significant Difference
M	Moles per litre
mM	Milimoles per litre
OD	Optical density
Pi	Inorganic phosphorus
PPO	Polyphenol oxidase



R-SH	Thiol group
RCBD	Randomized Complete Block Design
rpm	Revolutions per minute
RRIES	Rubber Research Institute Experiment Station
RRIM	Rubber Research Institute of Malaysia
TCA	Trichloroacetic acid
Tris	Tris (hydroxymethyl aminomethane)
TSC	Total solid content
Tx	Triton X-100



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A study was carried out to evaluate the effect of several ethephon concentrations (5%, 10% and 20%) on yield and some physiological parameters of latex obtained from Controlled Upward Tapping (CUT) of clone RRIM 600. The relationships between yield, physiological parameters and their interactions were investigated.

A good response to stimulation on yield was observed. The yields in stimulated treatments were from 192.5% to 267.7% of control over the time of the study.



The influence of the stimulant concentration on the yield varied with the duration of the study.

The variation of some physiological parameters under the effect of ethephon was similar to that observed in downward tapping. Total solid content (TSC), cytosolic pH, C serum invertase activity, bottom fraction (BF), thiol content and sucrose content exhibited a transitory change after each stimulation. However, the modification of inorganic phosphorus (Pi) content and Triton X-100 (Tx) serum invertase activity were observed after a few applications of stimulant. Polyphenol oxidase (PPO) activity was not affected by the stimulation.

Most of the physiological parameters were found to be correlated with yield except PPO activity. TSC had highly negative correlation with yield whereas pH, invertase activity, BF, Pi and thiols had highly positive correlation with yield. The negative yield-sucrose correlation was only observed in September. The interparametric correlations between some physiological parameters were also highlighted.

The progressive decrease of initial higher yield in stimulating with 20% ethephon as compared to stimulation



using the lower concentration 5% and 10% accompanied with some changes in the physiological parameters implied a possible unfavourable effect of high stimulant concentration.

These results suggested that stimulation induced variations in yield and some physiological parameters of latex using Controlled Upward Tapping (CUT) of clone RRIM 600. Furthermore, the effect of ethephon was influenced by the concentration applied and by the physiological status of laticiferous system of *Hevea* tree.



Abstrak Tesis Yang Dikemukakan Kepada Senat
Universiti Putra Malaysia Sebagai Memenuhi
Keperluan Untuk Ijazah Master Sains Pertanian

**PARAMETER-PARAMETER FISILOGI LATEKS HEVEA BRASILIENSIS
DARI TOREHAN MENAIK TERKAWAL DENGAN PERANGSANGAN ETEFON**

Oleh

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Satu kajian telah dijalankan untuk mengkaji kesan beberapa kepekatan etefon (5%, 10% dan 20%) ke atas hasil dan beberapa parameter fisiologi lateks klon RRIM 600 menggunakan sistem Torehan Menaik Terkawal (TMT). Perkaitan di antara hasil, parameter fisiologi dan interaksi di antara faktor-faktor tersebut juga dikaji.

Respon yang baik terhadap rangsangan ke atas hasil telah diperolehi. Peningkatan hasil dari rawatan dengan perangsangan adalah dari 192.5% hingga 267.7% berbanding



dengan kawalan di sepanjang tempoh kajian dijalankan. Pengaruh kekuatan perangsangan ke atas hasil adalah berbeza-beza di dalam tempoh kajian ini.

Perbezaan beberapa parameter fisiologi oleh kesan etefon adalah sama seperti yang diperhatikan pada torehan hala ke bawah. "Total solid content" (TSC), "cytosolic pH", aktiviti C serum "invertase", "bottom fraction" (BF), kandungan "thiol" dan kandungan sukrosa menunjukkan perubahan sementara selepas perangsangan. Sungguhpun demikian, modifikasi posforan bukan-organan (Pi) dan aktiviti Triton X-100 (Tx) serum "invertase" dikesan selepas beberapa amalan perangsangan. Aktiviti "polyphenol oxidase" (PPO) tidak dipengaruhi oleh amalan perangsangan.

Sebahagian besar parameter fisiologi didapati mempunyai perkaitan dengan hasil kecuali aktiviti PPO. TSC mempunyai perkaitan negatif yang tinggi dengan hasil manakala pH, aktiviti "invertase", BF, Pi dan "thiols" mempunyai perkaitan yang positif dengan hasil. Perkaitan negatif hasil-sukrosa hanya dikesan dalam bulan September. Perkaitan "interparametric" di antara beberapa parameter fisiologi juga ditunjukkan.



Penurunan secara progresif ke atas peningkatan hasil yang tinggi di peringkat awal dengan amalan perangsangan kepekatan etefon 20% berbanding dengan amalan perangsangan menggunakan kekuatan etefon 5% dan 10%, dituruti pula dengan perubahan pada parameter fisiologi, menunjukkan kemungkinan kesan jangka panjang yang tidak baik apabila mengamalkan perangsangan dengan kepekatan yang tinggi.

Keputusan-keputusan dari kajian ini mencadangkan bahawa perangsangan menyebabkan perubahan pada hasil dan parameter fisiologi lateks klon RRIM 600 ditoreh dengan sistem TMT. Kesan perangsangan dipengaruhi oleh kepekatan etefon yang digunakan dan juga oleh status fisiologi sistem "laticiferous" pokok *Hevea*.



CHAPTER I

INTRODUCTION

Natural rubber (polyisoprene), the predominant non-aqueous constituent of latex from the rubber tree *Hevea brasiliensis* is one of world's major crops. The technique of excision tapping whereby a thin shaving of bark is removed at each tapping (Ridley, 1890) enables a non-destructive method of harvesting the latex. Over the years, many exploitation techniques have been introduced to enhance yield output such as yield stimulation (Kamerun, 1912; Abraham et al., 1968a, 1968b; D'Auzac and Ribaillier, 1969), puncture tapping (Tupy, 1973a), Controlled Upward Tapping (P'Ng et al., 1976), micro-X system (Ismail Hashim et al., 1979). Recently, other tapping methods namely RRIMFLOW short cut system (Sivakumaran et al., 1995), REACTORRIM stimulation system (Mohd. Raffali and Ahmad Zarin, 1995) and AAR jacket system (Chan and Ong, 1995) have also been tested. Modern latex exploitation has evolved into various combinations



of cut, puncture, frequency and stimulation techniques (RRIM, 1989; Lukman, 1992).

In old mature rubber trees, the downward tapping of the base panel is predominant. However, the upward tapping of the high panel has also been applied. This method of tapping has been practised in many South-East Asian countries (Sharp, 1945; Campaignolle and Bouthillon, 1955; Van Brandt, 1973; Sookmark and Langlois, 1974). In Malaysia, Controlled Upward Tapping (CUT) of the high panel was introduced by P'Ng et al. (1976) and has been giving substantial yield increases with high economic returns in field experiments (P'Ng et al., 1976; Tan and Leong, 1978; Ismail Hashim et al., 1981a, 1981b; Lee et al., 1986; Gan and Chew, 1986; Ahmad Zarin et al., 1991). Similar results were also repeated in rubber plantation (Cho et al., 1981; Goh, 1986; Phang, 1986; Au Yong et al., 1991) and in smallholdings (Anthony and Abraham, 1981; Vanaga et al., 1987). The aim of CUT is to obtain a maximum return from the available bark of the high panel. Therefore, a shorter cut with stimulation has been recommended (P'Ng et al., 1976; Gan and Chew, 1986; RRIM 1989; Au Yong et al., 1991; Ahmad Zarin et al., 1991).