TABLE OF CONTENTS

	Page
TABLE OF CONTENTS	i
LIST OF TABLES	11
LIST OF FIGURES	V
LIST OF ABBREVIATIONS	X
INTRODUCTION	1
LITERATURE REVIEW	5
MATERIALS AND METHODS	14
RESULTS	28
DISCUSSION	72
CONCLUSION	83
LITERATURE CITED	86
APPENDIX	97
CURRICULUM VITAE	104

LIST OF TABLES

Table		Page
1	Rubber production expressed in kg/tree (kg/t).	29
2	Sucrose concentration ([Suc], mM/litre of latex) and Inorganic	
	phosphorus concentration ([Pi], mM/litre of latex) collected 5	
	cm under tapping cut.	29
3	The average trunk values of latex sucrose and latex inorganic	
	phosphorus in different tapping system.	30
4	Sucrose concentration ([Suc], mM/litre of latex) and Inorganic	
	phosphorus concentration ([Pi], mM/litre of latex) on tapped	
	panel and untapped panel.	31
5	Relation between estimated size of latex regeneration area,	
	production and average metabolic parameters (Suc, Pi)	
	measured inside latex of panel (A) of different tapping systems.	41
6	Main effect of treatment on non-structural carbohydrate	
	concentrations (mg_{Glu}/g_{SDM}) in trunk wood, as averaged for all	
	dates and distances from ground (0-2 m.).	44
7	Analysis of variance by combined treatments and panel of D/2	
	and D/4 (Tapped on panel A and untapped on panel B) for all	
	dates and distance from ground (0-2m.). Mean concentration of	
	non-structural carbohydrates (mg_{Glu}/g_{SDM}) in trunk wood.	44
8	Mean concentration of non-structural carbohydrate (mg_{Glu}/g_{SDM})	
	in trunk wood, per date, for all treatments and locations (0-2	47
	m.).	
9	Difference in starch concentration between tapped treatments	
	and control along the trunk wood in percent.	52
10	Difference in soluble sugar concentration between tapped	
	treatments and control along the trunk wood in percent.	52

LIST OF TABLES (continued)

Table		Page
11	Main effect of treatment on non-structural carbohydrate	
	concentrations (mg_{Glu}/g_{SDM}) in trunk bark, as averaged for all	
	dates and distances from ground (0-2 m.).	54
12	3-way Analysis of variance by combined treatments and panel	
	of Control (untapped tree on panel A), D/2 and D/4 (Tapped on	
	panel A and untapped on panel B) and DCA (both panel A and	
	B were tapped), for all dates and distance from ground (0-2m.).	
	Mean concentration of non-structural carbohydrates	
	(mg_{Glu}/g_{SDM}) in trunk bark.	54
13	Mean concentration of non-structural carbohydrate (mg _{Glu} /g _{SDM})	
	in trunk bark, per date, for all treatments and locations (0-2 m.).	57
14	Difference in starch concentration between tapped treatments	
	and control along the trunk bark in percent.	62
15	Difference in soluble sugar concentration between tapped	
	treatments and control along the trunk wood in percent.	62
16	Mean concentration of non-structural carbohydrates	
	(mg_{Glu}/g_{SDM}) in inner part of root and outer part of root, as	
	related to tapping treatment, for all dates and kind of roots	
	homogeneous groups.	64
17	Mean concentration of non-structural carbohydrates	
	(mg_{Glu}/g_{SDM}) in inner part of root and outer part of root, as	
	related to kind of roots, for all dates and treatments.	64
18	Mean concentration of non-structural carbohydrate (mg _{Glu} /g _{SDM})	
	in inner part of root and outer part of root, per date, for all	
	treatments and locations. (a, b, c): homogeneous groups.	65

LIST OF TABLES (continued)

Appendix	Table	Page
1	4-way analysis of variance of the effect of treatments (control,	
	D2, D4 and DCA), distance from ground (0-2m.) and sampling	
	date (9 dates) on starch, soluble sugars (SS) and total non-	
	structural carbohydrates (TNC) in trunk wood.	98
2	4-way Analysis of variance of the effect of treatments (control,	
	D2, D4 and DCA), distance from ground (0-2m.) and sampling	
	date (9 dates) on starch, soluble sugars (SS) and total non-	
	structural carbohydrates (TNC) in trunk bark.	99
3	Analysis of variance of the effect of combined treatments, inner	
	part of root and sampling date on starch, soluble sugars (SS) and	
	total non-structural carbohydrates (TNC).	100
4	Analysis of variance of the effect of combined treatments, outer	
	part of root and sampling date on starch, soluble sugars (SS) and	
	total non-structural carbohydrates (TNC).	100
5	Rain fall (mm.) in year 2002, 2003, 2004 and average 15 years	
	at Chachoengsao Rubber Research Center.	101

LIST OF FIGURES

Figure		Page
1	Tapping panel management of tapping system (1). D/2 or 1/2S	
	d/2 (2). D/4 or 1/2S d/3 ET 2.5%, 8/y and (3). DCA (Double cut	
	alternative system, 2x1/2S d/4 (t,t)).	17
2	Tapping panel management of tapping system (1). D/2 or 1/2S	
	d/2 (2). D/4 or 1/2S d/4 ET 2.5%, 6/y and (3). DCA (Double cut	
	alternative system, 2x1/2S d/4 (t,t)).	18
3	Diagram of sampling were taken on each treatment (1) D/2 or	
	1/2S d/2 (2). D/4 or 1/2S d/4 ET 2.5%, 6/y and (3) DCA (double	
	cut alternative system) or 2x1/2S d/4 (t,t).	20
4	Vertical distribution of latex sucrose content ([Suc], mM.l ⁻¹) and	
	inorganic phosphorus content ([Pi], mM.l ⁻¹) after 4 year of	
	tapping (September 2003) in panel A (tapped panel) of	
	RRIM600 clone, depending on distance from ground. Sampling	
	on tapped trees is performed every 15 cm from bottom to 200	
	cm above the ground. Number of samples depended on position	
	and width of renew bark [bark consumption of each treatment,	
	no data in these areas].	33
5	Vertical distribution of latex sucrose content ([Suc], mM.l ⁻¹) and	
	inorganic phosphorus content ([Pi], mM.l ⁻¹) after 4 year of	
	tapping (September 2003) in panel B (untapped panel for D/2	
	and D/3 , tapped panel for DCA)of RRIM600 clone, depending	
	on distance from ground. Sampling on tapped trees is performed	
	every 15 cm from bottom to 200 cm above the ground. Number	
	of samples depended on position and width of renew bark [bark	
	consumption of each treatment, no data in these areas].	34

Figure		Page
6	Vertical distribution of latex sucrose content ([Suc], mM.1 ⁻¹) and	
	inorganic phosphorus content ([Pi], mM.l ⁻¹) after 5 year of	
	tapping (October 2004) in panel A (tapped panel) of RRIM600	
	clone, depending on distance from ground. Sampling on tapped	
	trees is performed every 15 cm from bottom to 200 cm above	
	the ground. Number of samples depended on position and width	
	of renew bark [bark consumption of each treatment, no data in	
	these areas].	35
7	Vertical distribution of latex sucrose content ([Suc], mM.1 ⁻¹) and	
	inorganic phosphorus content ([Pi], mM.l ⁻¹) after 5 year of	
	tapping (October 2004) in panel B (untapped panel for D/2 and	
	$\ensuremath{\mathrm{D/3}}$, tapped panel for DCA) of RRIM600 clone, depending on	
	distance from ground. Sampling on tapped trees is performed	
	every 15 cm from bottom to 200 cm above the ground. Number	
	of samples depended on position and width of renew bark [bark	
	consumption of each treatment, no data in these areas].	36
8	Latex metabolic activity areas determined by latex Pi level	
	(Average of 4 replications per treatment) (8a) D/2, (8b) D/3	
	and (8c) DCA system.	39
9	Latex sucrose content distribution in the lower part of the trunk	
	(average of 4 replications per treatment). The estimated latex	
	regeneration area was limited by low Sucrose and high Pi. (9a)	
	D/2, (9b) D/3 and (9c) DCA system.	40
10	Relation between latex sucrose content (Suc) and latex	
	inorganic phosphorus content (Pi): all sampling positions	42

Figure		Page
11	Mean carbohydrate concentration (mg _G /g _{SDM}) in trunk wood, up	
	to 600 cm, at 9 sampling dates. February 2003 and January	
	2004– leafless stage, March 2003 and February 2004 – at the	
	end of re-foliation, May 2003 and May 2004 – resting period for	
	tapping, October 2003 and October 2004 – high latex	
	production period. starch; SS, total soluble sugars; TNC, total	
	non-structural carbohydrates.	48
12	Vertical distribution of starch on panel A (left side) and starch	
	on panel B (right side) in trunk wood. Panel A was tapped in	
	D/2 and D/4 whereas panel B was untapped. Both panel A and	
	B were tapped in DCA, average from 9 dates.	50
13	Vertical distribution of SS, total soluble sugar on panel A (left	
	side) and SS on panel B (right side) in trunk wood. Panel A was	
	tapped in D/2 and D/4 whereas panel B was untapped. Both	
	panel A and B were tapped in DCA, average from 9 dates.	51
14	Mean carbohydrate concentration (mg _{Glu} /g _{SDM}) in trunk bark on	
	panel A, up to 600 cm, at 9 sampling dates. February – leafless	
	stage, March – at the end of re-foliation, May – resting period	
	for tapping, October – high latex production period. St, starch;	
	SS, total soluble sugars; TNC, total non-structural	
	carbohydrates.	58
15	Vertical distribution of SS, total soluble sugars on panel A (left	
	side) and SS on panel B (right side) in trunk bark, average from	
	9 dates.	60
16	Vertical distribution of starch on panel A (left side) and starch	0.0
- 3	on panel B (right side) in trunk bark, average from 9 dates.	61

Figure		Page
17	Influence of the volume of the extract on the total amylase	
	activity (100 mM Hepes pH 8.0, KOH	66
18	Influence of incubation time on total amylase activity (100 mM	
	Hepes pH 8.0 KOH).	67
19	Influence of enzyme concencentration on Sucrose Phosphate	
	Synthase (SPS) activity (4X SPS buffer: 400 mM Hepes pH 7.5	
	NaOH , 100 mM MgCl $_{\!2},20$ mM F6P, 100 mM G6P, UDPG 80	
	mM and H ₂ O).	68
20	Influence of time incubation on Sucrose Phosphate Synthase	
	(SPS) activity (4X SPS buffer: 400 mM Hepes pH 7.5 NaOH,	
	$100\ mM\ MgCl_2,20\ mM\ F6P,100\ mM\ G6P,UDPG\ 80\ mM$ and	68
	H_2O).	
21	Cell Wall Invertase (CWI) activity related to the extract volume	
	of enzyme. (the 2x invertase assay buffer: 70 mM K ₂ HPO ₄ , 40	
	mM citric acid, pH 5.0, 50 mM sucrose).	69
22	Cell Wall Invertase (CWI) activity related to incubation time 0 -	
	60 minutes (the 2x invertase assay buffer: 70 mM K2HPO4, 40	
	mM citric acid, pH 5.0, 50 mM sucrose).	69
23	Total amylase activity in PB 235 and RRIM 600 (FW - fresh	
	wood, DW –dry wood).	70
24	SPS (Sucrose Phosphate Synthase) activity in the wood and the	
	bark of clone PB 235 and RRIM 600.	71
25	Cell Wall Invertase activity in PB 235 and RRIM 600.	72

Appendi	x Figure	Page
1	Comparison of seasonal dynamics of SS and starch in wood and	
	bark provided information on the relative role of the four	
	carbohydrate components: SS in wood, SS in bark, starch in	
	wood and starch in bark.(left side: control or untapped tree,	
	right side: D/2 (1/2S d/2))	102
2	Comparison of seasonal dynamics of SS and starch in wood and	
	bark provided information on the relative role of the four	
	carbohydrate components: SS in wood, SS in bark, starch in	
	wood and starch in bark.(left side: D/4 treatment, right side:	
	DCA treatment)	103

LIST OF ABBREVIATIONS

LD = Latex diagnosis technique

Suc = Sucrose latex concentration (mM.l⁻¹)

Pi = Inorganic phosphorus concentration (mM.l⁻¹)

RSH = Thiol concentration $(mM.l^{-1})$

SS = Total soluble sugar $(mg_G.g^{-1}_{SDM})$

TNC = Total nonstructural carbohydrate $(mg_G.g^{-1}_{SDM})$

 $mg_G.g^{-1}_{SDM}$ = mg glucose eguivalent per gram structural dry matter