RESULTS

3.1 VARIATIONS IN PHYSIOLOGICAL AND BIOCHEMICAL PARAMETERS ASSOCIATED WITH LATEX PRODUCTION.

Results of the study conducted in clone RRII 105 under ½ S d/2 6d/7 tapping system are presented in this chapter. Analysis of variance was carried out to study the seasonal differences in dry rubber yield, dry rubber content, total thiols, sucrose and inorganic phosphorous in latex. Regression analysis of these parameters with yield was worked out using the pooled data of one year. Independent t test was carried out to study the seasonal variations in biochemical parameters.

3.1.1 Monthly variations in yield and other physiological parameters related to yield

Monthly variations in yield and other physiological parameters of newly opened trees of clone RRII 105 are presented in figures 1-5. Maximum dry rubber yield was observed during peak season (Figure 1). Maximum sucrose content in latex was observed during the month of March. (Figure 3). All the months in peak season showed high in organic phosphorus. (Figure 4)
Figure-1 Monthly variations in dry rubber yield of newly opened trees of clone RRII 105 under 1/2 S d/2 6d/7 tapping system
Figure 2: Monthly variations in dry rubber content in newly opened trees of clone RR11 105 under 1/2 S d/2 6 d/7 tapping system.
Figure 3. Monthly variations in latex sucrose in newly opened trees of clone RR11 106 under 1/2 S d/2 6d/7 tapping system.
Figure 4 Monthly variations in latex inorganic phosphorous in newly opened trees of clone RR1105 under 1/2 S d/2 8 d/7 tapping system.
Figure 5: Monthly variations in latex thiols in newly opened trees of clone RRll 105 under 1/2 S d/2 6d/7 tapping system.
3.1.2. Seasonal variations in yield and other physiological parameters related to yield in clone RRII 105 under ½ S d/2 6d/7 system of tapping

Seasonal variations in yield and physiological parameters are presented in Table 1. Inorganic phosphorous and sucrose in latex, drc, dry rubber yield were found to be significantly higher during peak season when compared to stress season. Thiols were significantly lower during peak season.

Table 1. Seasonal variations in dry rubber yield and related physiological and biochemical parameters in clone RRII 105 under 1/2S d/2 6d/7 system of tapping.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Peak season</th>
<th>Stress season</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (g tree⁻¹ tap⁻¹)</td>
<td>102.3</td>
<td>56.4</td>
<td>15.1 **</td>
</tr>
<tr>
<td>Dry rubber content (%)</td>
<td>43.03</td>
<td>35.29</td>
<td>3.09 *</td>
</tr>
<tr>
<td>Sucrose (mM)</td>
<td>8.22</td>
<td>9.74</td>
<td>1.28 *</td>
</tr>
<tr>
<td>Inorganic phosphorus (mM)</td>
<td>13.95</td>
<td>9.25</td>
<td>1.9 *</td>
</tr>
<tr>
<td>Thiol (mM)</td>
<td>0.15</td>
<td>0.25</td>
<td>0.03 **</td>
</tr>
</tbody>
</table>

** CD (P=0.01)  * CD (P=0.05)
3.1.3. Relationship between yield and other physiological parameters related to yield

The results are presented in Table-2. Regression analysis showed a positive correlation between yield, Pi, and Thiols and Sucrose showed a negative correlation.

Table-2. Correlation between yield and physiological parameters (pooled data of one year).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>T-Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant (Yield)</td>
<td>10.942</td>
<td>82.071</td>
<td>0.1333</td>
</tr>
<tr>
<td>Thiols in latex</td>
<td>166.80</td>
<td>71.687</td>
<td>2.326  *</td>
</tr>
<tr>
<td>Inorganic phosphorus in latex</td>
<td>3.484</td>
<td>1.049</td>
<td>3.318  **</td>
</tr>
<tr>
<td>Sucrose in latex</td>
<td>-5.361</td>
<td>2.717</td>
<td>-1.972 *</td>
</tr>
</tbody>
</table>
3.1.4. Seasonal variations in bursting index, pH and enzymes involved in proton transport

The results are presented in Table 3. The bursting index of lutoids showed an increase during stress when compared to peak season. Latex and c-serum pH showed a decrease during stress period. There was no significant difference in b-serum pH. Pyrophosphatase activity and ATPase activities in lutoids were high during peak season when compared to stress.

Table-3. Seasonal variations in bursting index and pH in clone RRII 105 under 1/2S d/2 6d/7 system of tapping.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Peak season</th>
<th>Stress season</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bursting Index</td>
<td>5.79±0.38</td>
<td>13.9±0.82</td>
<td>*</td>
</tr>
<tr>
<td>Latex pH</td>
<td>7.15±0.062</td>
<td>6.07±0.085</td>
<td>*</td>
</tr>
<tr>
<td>C-serum pH</td>
<td>6.89±0.065</td>
<td>6.5±0.066</td>
<td>*</td>
</tr>
<tr>
<td>B-serum pH</td>
<td>5.58±0.059</td>
<td>5.66±0.07</td>
<td>ns</td>
</tr>
<tr>
<td>ATPase(lutoid)</td>
<td>3.91±0.36</td>
<td>2.83±0.27</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>(μmole Pi min⁻¹ mg protein⁻¹)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lutoid pyrophosphatase</td>
<td>4.44±0.41</td>
<td>3.99±0.37</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>(μmole Pi min⁻¹ mg protein⁻¹)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*significant at p<0.05    ns- not significant

A negative correlation between total volume and BI was observed (Fig-6).
Figure 6: Relationship between total volume and bursting index in clone RRII 105 under 1/2 S d/2 6 d/7 tapping system (peak yielding season)
3.1.5. Seasonal variation in parameters related to energy metabolism and related enzyme (pyro phosphatase in C-serum) in clone RRII 105 under 1/2S d/2 6d/7 system of tapping

The result of this experiment are presented in Table 4. Inorganic phosphorus and pyrophosphatase in C-serum showed a significant increase in peak season and pyrophosphate in C-serum showed a decrease during peak season (Table 4).

Table-4. Seasonal variations in biochemical parameters associated with latex production in clone RRII 105 under 1/2S d/2 6d/7 system of tapping.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Peak season</th>
<th>Stress season</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-serum phosphorus (mg/ml)</td>
<td>0.48±0.025</td>
<td>0.37±0.019</td>
<td>*</td>
</tr>
<tr>
<td>C-serum pyrophosphate (mM)</td>
<td>3.27±0.15</td>
<td>4.41±0.02</td>
<td>*</td>
</tr>
<tr>
<td>C-serum pyrophosphatase (μmole Pi min(^{-1}) mg protein(^{-1}))</td>
<td>13.82±0.28</td>
<td>12.96±0.20</td>
<td>*</td>
</tr>
</tbody>
</table>

*significant at p<0.05   ns- not significant

C-serum Pi showed a positive and C-serum PPI showed a negative correlation with yield (Fig-7&8)
Figure 7 Relationship between latex yield and c-serum Pi in clone RRN 105 under 1/2 S d/2 5d/7 tapping system (peak yielding season)
Late, old (ml/tree/top) Figare-2 Relationship between latex yield and c-serum PPI in clone RR11 105 under 1/2 S d/2 6 d/7 topping system (peak yielding season).
3.1.6. Seasonal variations in phospholipids, glycolipids and carbohydrate components in clone RRII 105 under 1/2S d/2 6d/7 system of tapping.

Glycolipids in latex and phospholipids in latex and bottom fraction showed an increase during peak period. Glycolipids in rubber cream and bottom fraction and phospholipids in rubber cream showed no difference. Fucose and hexose in B-serum showed an increase during peak season when compared to stress period. Sialic acid shows an increase during stress season. (Table 5).Hexose and fucose showed a positive correlation with total volume and yield (Fig-10 &11). A positive correlation was observed between phospholipids in bottom fraction and yield.(Figure 9).

Table 5. Seasonal variations in phospholipids, glycolipids carbohydrate components in clone RRII 105 under 1/2S d/2 6d/7 system of tapping.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Peak season</th>
<th>Stress season</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latex Glycolipids mg/g dry wt.</td>
<td>12.69±0.53</td>
<td>7.6±0.68</td>
<td>*</td>
</tr>
<tr>
<td>Latex phospholipids mg/g dry wt.</td>
<td>6.47±0.19</td>
<td>3.18±0.36</td>
<td>*</td>
</tr>
<tr>
<td>Rubber cream glycolipids mg/g dry wt.</td>
<td>5.51±0.38</td>
<td>5.45±0.74</td>
<td>ns</td>
</tr>
<tr>
<td>Rubber cream phospholipids mg/g dry wt.</td>
<td>2.02±0.24</td>
<td>2.29±0.33</td>
<td>ns</td>
</tr>
<tr>
<td>Bottom fraction glycolipids mg/g dry wt.</td>
<td>38.73±2.97</td>
<td>38.61±1.37</td>
<td>ns</td>
</tr>
<tr>
<td>Bottom fraction phospholipids mg/g dry wt.</td>
<td>20.54±1.98</td>
<td>13.31±0.92</td>
<td>*</td>
</tr>
<tr>
<td>b-serum (mg/ml) fucose</td>
<td>5.599±0.556</td>
<td>4.49±0.294</td>
<td>*</td>
</tr>
<tr>
<td>b-serum (mg/ml) hexose</td>
<td>7.92±0.3015</td>
<td>6.0±0.442</td>
<td>*</td>
</tr>
<tr>
<td>Sialic acid in B-serum (µmoles)</td>
<td>0.01428±0.00106</td>
<td>0.02025±0.0022</td>
<td>*</td>
</tr>
</tbody>
</table>

*significant at p<0.05      ns- not significant
Fig. 9. Relationship between yield and phospholipids in clone RR1105 under 1/2 S d/2 6d/7 tapping system.
Figure 1: Relationship between latex yield and b-serum hexose in clone RH 106 under 1/2 S d/2 6 d/7 tapping system (peak yielding season)
Figure II  Relationship between latex yield and b-serum fucose in clone RRII 105 under 1/2 S d/2 6 d/7 tapping system (peak yielding season)
3.2. Seasonal variations in carbohydrates and related enzymes associated with latex production in clone RRII 105 under 1/2S d/2 6d/7 system of tapping

Results of seasonal variations in carbohydrate and associated enzymes are shown in Table- 6. Independent t test was used for analysis. Yield was minimum during summer and maximum during peak season (i.e September.-November). When defoliation and refoliation period was considered yield was minimum during defoliation. Latex sucrose during refoliation was lower than that during defoliation. Latex sucrose during summer was more than that of peak season. Trend of C-serum sucrose was similar to latex sucrose. Invertase activity was low during defoliation when compared to refoliation period. Maximum invertase activity in C-serum was observed during peak yielding period followed by refoliation, defoliation and summer. Sucrose synthase in C-serum during summer was maximum and minimum on defoliation.

A negative correlation was observed between sucrose in latex and yield. (Fig -12). Invertase was positively correlated with yield and total volume (Fig- 13&14)
Table-6. Seasonal variation in carbohydrates and related enzymes in cloneRRII

105 under 1/2S d/2 6d/7 system of tapping system parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Peak</th>
<th>Defoliation</th>
<th>Refoliation</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (gm tree(^{-1}) tap(^{-1}))</td>
<td>104.35±6.98</td>
<td>67.52±3.95</td>
<td>87.77±4.82</td>
<td>43.31±2.88</td>
</tr>
<tr>
<td>Sucrose in latex (mM)</td>
<td>8.22±0.67</td>
<td>10.32±0.98</td>
<td>6.89±0.54</td>
<td>9.74±0.93</td>
</tr>
<tr>
<td>Sucrose in c-serum (mM)</td>
<td>14.46±5.08</td>
<td>8.74±0.43mM</td>
<td>7.94±0.55mM</td>
<td>20.96±5.67</td>
</tr>
<tr>
<td>Invertase in C-serum (nmole sucrose min(^{-1}) mg protein(^{-1}))</td>
<td>176.3±8.68</td>
<td>135.2±3.77</td>
<td>73.69±5.89</td>
<td>67.82±8.42</td>
</tr>
<tr>
<td>Sucrose synthase in C-serum (nmole sucrose/min/mg protein)</td>
<td>40.39±4.12</td>
<td>11.24±1.35</td>
<td>40.36±2.73</td>
<td>119.35±6.88</td>
</tr>
</tbody>
</table>
Figure 12. Relationship between yield and latex sucrose in clone RR11 105 under 1/2 S d/2 6d/7 tapping system (peak yielding season)
Figure 13: Relationship between total volume and c-serum invertase in clone RRII 105 under 1/2 S d/2 6 d/7 tapping system (peak yielding season)
Fig. 14. Relationship between yield and invertase in C-serum in clone RRII 105 under ½ S d/2 6d/7 tapping system (Peak season)
3.3. Clonal variations in parameters associated with latex production

Results of the study carried out in high and low yielding clones were presented in this chapter. Co variance analysis was used to compare the clonal variation.

3.3.1. Clonal variations in yield and carbohydrate metabolism

Results are presented in Table 7. Yield was significantly high in high yielding clones compared to low yielders. DRC showed no significant difference. No consistent pattern in C-serum sucrose was observed. Sucrose in latex was high in low yielders when compared to high yielding clones. C-serum invertase was significantly high in high yielding clones when compared to low yielders. C-serum sucrose synthase showed no significant difference between high and low yielders. Results are presented in Table 7.

3.3.2. Clonal variations in pH and ATPase, an enzyme involved in proton transport (pH regulation).

Variations in pH and ATPase were shown in Table 8. Latex pH showed no significant difference between high and low yielding clones. C-pH was significantly high in high yielding clones. B-pH was low in high yielding clones. ATPase in lutoid was high in high yielding clones when compared to low yielders.
Table 7. Clonal variations in carbohydrates and related enzymes in different clones

<table>
<thead>
<tr>
<th>Category</th>
<th>Clones</th>
<th>Yield (gm tree(^{-1}) tap(^{-1}))</th>
<th>DRC (%)</th>
<th>c-serum sucrose (mM)</th>
<th>Latex sucrose (mM)</th>
<th>C-Invertase (nmol sucrose min(^{-1}) mg protein(^{-1}))</th>
<th>C-Sucrose synthase (nmol sucrose/min/mg protein)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High yielding</td>
<td>RRH 105</td>
<td>69.98</td>
<td>33.02</td>
<td>19.56</td>
<td>6.63</td>
<td>81.52</td>
<td>28.31</td>
</tr>
<tr>
<td></td>
<td>RRIM 600</td>
<td>53.98</td>
<td>33.08</td>
<td>9.54</td>
<td>4.26</td>
<td>83.46</td>
<td>24.02</td>
</tr>
<tr>
<td>Low yielding</td>
<td>HP 20</td>
<td>35.74</td>
<td>38.03</td>
<td>17.71</td>
<td>9.03</td>
<td>43.28</td>
<td>28.06</td>
</tr>
<tr>
<td></td>
<td>RRH 38</td>
<td>39.69</td>
<td>36.06</td>
<td>8.88</td>
<td>10.23</td>
<td>43.18</td>
<td>21.33</td>
</tr>
<tr>
<td>CD (p=0.05)</td>
<td></td>
<td>13.56</td>
<td>4.63</td>
<td>5.31</td>
<td>2.88</td>
<td>5.38</td>
<td>11.96</td>
</tr>
</tbody>
</table>

Table 8. Clonal variations in pH and lutoid ATPase

<table>
<thead>
<tr>
<th>Category</th>
<th>Clones</th>
<th>Latex pH</th>
<th>C-pH</th>
<th>b-pH</th>
<th>Lutoid ATPase μmole Pi/min/mg protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>High yielding</td>
<td>RRH 105</td>
<td>6.91</td>
<td>6.698</td>
<td>5.51</td>
<td>5.62</td>
</tr>
<tr>
<td></td>
<td>RRIM 600</td>
<td>6.84</td>
<td>6.486</td>
<td>5.34</td>
<td>4.27</td>
</tr>
<tr>
<td>Low yielding</td>
<td>HP 20</td>
<td>6.79</td>
<td>6.409</td>
<td>5.66</td>
<td>2.96</td>
</tr>
<tr>
<td></td>
<td>RRH 38</td>
<td>6.81</td>
<td>6.356</td>
<td>5.73</td>
<td>2.33</td>
</tr>
<tr>
<td>CD</td>
<td></td>
<td>0.18</td>
<td>0.067</td>
<td>0.252</td>
<td>1.39*</td>
</tr>
</tbody>
</table>
3.3.3. Clonal variations in parameters related to energy metabolism

Variations in inorganic phosphorous in latex, C-serum, and B-serum were presented in Table 9. Latex Pi was high in high yielding clones and low in low yielding clones. C-serum Pi and B-serum Pi also showed the similar pattern. N-acetyl glucosaminidase in B-serum was high in high yielding clones. Pyrophosphatase in C-serum was high in high yielding clones when compared to low yielders.

3.3.4 Clonal variations in hevein

No consistent variation was observed in the hevein content of B-serum between clones (Fig-15). Among the four clones the low yielder HP-20 showed a higher hevein content in B-serum. The other low yielder RRII 38 showed the same trend of high yielding clones. Hevein is a clonal character.
Table-9. Clonal variations in Pi (Latex, C-serum, B-serum), PPase in C-serum and N-Acetyl glucosaminidase in B-serum.

<table>
<thead>
<tr>
<th>Category</th>
<th>Clones</th>
<th>Latex PimM</th>
<th>C-serum Pi mM</th>
<th>b-serum PimM</th>
<th>C-serum pyrophosphatase μmolePi/min/mg protein</th>
<th>N-Acetyl Glucosaminidase mg p. nitro phenol/min/mg protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>High yielding</td>
<td>RRII 105</td>
<td>7.52</td>
<td>7.37</td>
<td>75.47</td>
<td>14.9</td>
<td>0.675</td>
</tr>
<tr>
<td></td>
<td>RRIM 600</td>
<td>5.38</td>
<td>7.17</td>
<td>61.26</td>
<td>12.5</td>
<td>0.517</td>
</tr>
<tr>
<td>Low yielding</td>
<td>HP 20</td>
<td>2.56</td>
<td>4.53</td>
<td>29.23</td>
<td>10.6</td>
<td>0.422</td>
</tr>
<tr>
<td></td>
<td>RRII 38</td>
<td>3.24</td>
<td>3.49</td>
<td>59.75</td>
<td>10.96</td>
<td>0.289</td>
</tr>
<tr>
<td></td>
<td>CD</td>
<td>3.23</td>
<td>1.88</td>
<td>12.79</td>
<td>1.96</td>
<td>0.151</td>
</tr>
</tbody>
</table>
Fig15 Hevein content of B-serum of different clones under d/2 system of tapping (Peak season). Protein content 6.0 mg on a sephadex G-25 column (3x50 cm). Elution with 1.2 M acetic acid. Fractions of 3.5 ml were collected.
3.4. Physiological and biochemical parameters related to carbohydrate metabolism and ionic balance under $\frac{1}{2} S \, d/2$ 6d/7 and $\frac{1}{2} S \, d/4$ 6d/7 tapping system in clone RRII 105.

The results of various parameters related to latex production are presented in this chapter. The data of peak yielding period of 1999 was used. Co variance analysis was used for comparing yield, succrose and thiols. Independent t test was used for comparison.

3.4.1. Monthly variations in yield and physiological parameters in clone RRII 105 under $\frac{1}{2} S \, d/2$ 6d/7 and $\frac{1}{2} S \, d/4$ 6d/7 tapping system.

The monthly variations in yield, drc, succrose, thiol and Pi are presented in figures 16-20. Both d/2 and d/4 system of tapping showed distinct monthly variations in all these parameters.

3.4.2. Effect of tapping frequency on parameters related to carbohydrate metabolism

Results are shown in Table 10. Yield was significantly high in d/2-tapped trees when compared to d/4 tapped trees during the peak yielding season of 1999. Tapping treatments have no significant effect on sucrose content in latex, and c-
serum. Carbohydrate components also showed no significant difference between d/2 and d/4 tapped trees. c- serum invertase showed an increase in d/2 tapped trees. C-serum sucrose synthase showed a decrease.

Table-10 Effect of tapping frequency on carbohydrates in clone RRII 105.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>High frequency</th>
<th>Low frequency</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/2 S d/2 6d/7</td>
<td>1/2 S d/4 6d/7</td>
<td></td>
</tr>
<tr>
<td>Yield (g tree⁻¹ tap⁻¹)</td>
<td>95.27</td>
<td>67.31</td>
<td>10.3 **</td>
</tr>
<tr>
<td>Sucrose in latex(mM)</td>
<td>9.03</td>
<td>8.46</td>
<td>1.09 ns</td>
</tr>
<tr>
<td>Thiols in latex(mM)</td>
<td>0.205</td>
<td>0.132</td>
<td>0.066 *</td>
</tr>
<tr>
<td>c-serum sucrose (mg/ml)</td>
<td>5.07±0.55</td>
<td>4.1±0.65</td>
<td>ns</td>
</tr>
<tr>
<td>b-serum fucose (mg/ml)</td>
<td>6.64±0.09</td>
<td>7.97±0.08</td>
<td>ns</td>
</tr>
<tr>
<td>b-serum hexose (mg/ml)</td>
<td>8.03±0.35</td>
<td>8.15±0.38</td>
<td>ns</td>
</tr>
<tr>
<td>DRC (%)</td>
<td>43.3±0.45</td>
<td>41.5±0.67</td>
<td>*</td>
</tr>
<tr>
<td>Invertase (C-serum) nmole sucrose/min/mg protein</td>
<td>211.49±14.02</td>
<td>138.79±7.11</td>
<td>*</td>
</tr>
<tr>
<td>Sucrose synthase (C-serum) nmole sucrose/min/mg protein</td>
<td>78.03±5.71</td>
<td>118.98±9.13</td>
<td>*</td>
</tr>
</tbody>
</table>
Figure: Monthly variations in dry rubber yield in newly opened trees of clone RR11 105 under 1/2 S d/2 6d/7 and 1/2 S d/4 6d/7 tapping systems.
Figure 1: Monthly variations in dry rubber content in newly opened trees of clone RRll 105 under 1/2 S d/2 6 d/7 and 1/2 S d/4 6 d/7 tapping systems.
Figure 4B: Monthly variations in latex thiols in newly opened trees of clone RRII 105 under 1/2 S d/2 6 d/7 and 1/2 S d/4 6 d/7 tapping systems.
Figure 1: Monthly variations in latex sucrose in newly opened trees of clone RRll 106 under 1/2 S d2, 6d7 and 1/2 S d4, 6d7 tapping systems.
Figure 20: Monthly variations in latex inorganic phosphorus in newly opened trees of clone RR11 105 under 1/2 S d/2 6d/7 and 1/2 S d/4 6d/7 tapping systems.
3.4.3. Effect of tapping frequency on parameters regulating latex production (Pi, PPI, C-serum PPase, N-acetyl glucosaminidase & Chitinase in B-serum)

The results are presented in Table-1. C-serum Pi, C-serum PPI and N acetyl glucosaminidase showed an increase in d/2 tapped trees when compared to d/4 tapped trees. No significant variation was observed in pyrophosphatase in C-serum and chitinase in B-serum between two treatments.

Table-1. Effect of tapping frequency on Pi, PPI, PPase in C-serum, N acetyl glucosaminidase in B-serum, Chitinase in B-serum

<table>
<thead>
<tr>
<th>Parameters</th>
<th>High frequency</th>
<th>Low frequency</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/2 S d/2 6d/7</td>
<td>1/2 S d/4 6d/7</td>
<td></td>
</tr>
<tr>
<td>c-serum Pi (mg/ml)</td>
<td>0.47±0.022</td>
<td>0.369±0.016</td>
<td>*</td>
</tr>
<tr>
<td>c-serum PPI (mg/ml)</td>
<td>0.796±0.038</td>
<td>0.594±0.022</td>
<td>*</td>
</tr>
<tr>
<td>Pyrophosphatase (C-Serum) μmole phos./min/mg protein</td>
<td>3.2±1.5</td>
<td>2.96±1.25</td>
<td>ns</td>
</tr>
<tr>
<td>Nacetylglucosaminidase (B-serum) mg p.nitrophenol/min/mg protein</td>
<td>0.42±0.021</td>
<td>0.24±0.012</td>
<td>*</td>
</tr>
<tr>
<td>Chitinase (B-serum) units/min/mg protein</td>
<td>0.0018±0.00026</td>
<td>0.0020±0.00018</td>
<td>ns</td>
</tr>
</tbody>
</table>

*Significant at 0.05 level

3.4.4. Effect of tapping frequency on pH and its regulating enzyme

Latex pH and B-serum Ph did not show any significant difference between treatments. C- pH showed an increase in d/2-tapped trees. ATPase activity in lutoids did not show any significant significant difference between high and low frequency tapped trees.
Table- 12. Effect of tapping frequency on pH and related enzymes in clone RRI 105

<table>
<thead>
<tr>
<th>Parameters</th>
<th>High frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/2 S d/2 6d/7</td>
</tr>
<tr>
<td></td>
<td>1/2 S d/4 6d/7</td>
</tr>
<tr>
<td>latex-pH</td>
<td>7.15±0.062</td>
</tr>
<tr>
<td>c-pH</td>
<td>6.885±0.065</td>
</tr>
<tr>
<td>b-pH</td>
<td>5.58±0.0599</td>
</tr>
<tr>
<td>ATP ase(bottom)</td>
<td>3.91±.36</td>
</tr>
<tr>
<td>µmole phosphorus/min/mg protein</td>
<td></td>
</tr>
</tbody>
</table>

3.4.5. Effect of tapping frequency on amount of bottom, cream and C-serum.

Weight of bottom fraction was high in d/2 tapped trees when compared to d/4 tapped trees. No significant difference was observed in weight of rubber cream and volume of c-serum between d/2 and d/4 tapped trees.

Table- 13. Effect of tapping frequency on weight of bottom, cream and volume of c-serum in clone RRI 105

<table>
<thead>
<tr>
<th>Parameters</th>
<th>High frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/2 S d/2 6d/7</td>
</tr>
<tr>
<td></td>
<td>1/2 S d/4 6d/7</td>
</tr>
<tr>
<td>Weight of bottom fraction (g/g fresh wt.)</td>
<td>0.177±0.008</td>
</tr>
<tr>
<td>Weight of rubber cream (g/g fresh wt.)</td>
<td>0.409±0.019</td>
</tr>
<tr>
<td>Vol.of c-serum (ml/g fresh wt.)</td>
<td>0.391±0.0093</td>
</tr>
</tbody>
</table>
3.4.6. Effect of tapping frequency on latex lipids related to stability of membrane

The results are presented in Table-14. Latex glycolipids and phospholipids in latex and bottom fraction were significantly higher in high frequency tapped trees when compared to low frequency tapped trees. Glycolipids in cream and bottom and phospholipids in rubber cream showed no significant difference.

Table-14. Effect of tapping frequency on latex lipids in clone RRII 105

<table>
<thead>
<tr>
<th>Parameters</th>
<th>High frequency</th>
<th>Low frequency</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycolipid (latex) mg/g dry wt.latex</td>
<td>12.69±0.53</td>
<td>10.08±0.603</td>
<td>*</td>
</tr>
<tr>
<td>Glycolipid (bottom) mg/g dry wt.bottom</td>
<td>38.73±2.969</td>
<td>35.835±3.145</td>
<td>ns</td>
</tr>
<tr>
<td>Glycolipid (cream) mg/g dry wt.cream</td>
<td>5.508±0.378</td>
<td>5.74±0.756</td>
<td>ns</td>
</tr>
<tr>
<td>Phospholipids latex mg/g dry wt.latex</td>
<td>6.43±0.197</td>
<td>5.01±0.171</td>
<td>*</td>
</tr>
<tr>
<td>Phospholipid bottom)mg/g dry wt.bottom</td>
<td>20.54±1.98</td>
<td>15.87±1.078</td>
<td>*</td>
</tr>
<tr>
<td>Phospholipid (cream) mg/g dry wt.cream</td>
<td>2.024±0.24</td>
<td>2.68±0.626</td>
<td>ns</td>
</tr>
</tbody>
</table>
3.5. Effect of stimulation (stimulation with normal tapping, stimulation with intensive tapping, stimulation with tapping rest) on carbohydrate metabolism and ionic balance in clone RRII 105 under 1/2S d/4 6d/7 system of tapping

3.5.1. Total volume

Control and stimulated

Total volume of latex increased on all tapping days after stimulation (fig-21).

Stimulation and intensive tapping

A general increase was observed on all intensive tapping days after stimulation, Maximum volume was observed on second and third intensive tapping (Fig-22)

Stimulation and tapping rest

Total volume of latex was found to be maximum in trees with six day rest after stimulation and 2 day rest and 10 day rested trees showed a higher volume than control (Fig-23)

Fig-21. Effect of stimulation on total volume in clone RRII 105 under ½ S d/4 6d/7 tapping system (mean of six trees ± SE)

d/4-c: control    d/4-s: stimulated
Fig-22 Effect of sequential tapping after stimulation on latex yield in clone RRII 105 under $\frac{1}{2}$ S d/4 6d/7 tapping system (mean of six trees ± SE)

Fig-23 Effect of tapping rest after stimulation on latex yield in clone RRII 105 under $\frac{1}{2}$ S d/4 6d/7 tapping system
3.5 Dry rubber content

Control and stimulated

DRC of stimulated trees were always lower than that of control trees. The reduction was observed in the first tapping onwards after stimulation (Fig-24).

Stimulation and intensive tapping

A decrease in DRC was observed after second intensive tapping onwards (Fig-25).

Stimulation and tapping rest

DRC was minimum in trees with six and ten day tapping rest after stimulation and then increased in trees with 10 day rest and on fourteen-day rest it was higher than that of unstimulated trees (Fig-26).

Fig- 24 Effect of stimulation on DRC in clone RRII 105 under ½ S d/4 6d/7 tapping system (mean of six trees ±SE)

d/4-c: control    d/4-s: stimulated
Fig. 25 Effect of intensive tapping after stimulation on DRC in clone RRRI 105 under \( \frac{1}{2} S \ d/4 \ 6d/7 \) tapping system (mean of six trees ± SE).

Fig. 26 Effect of tapping rest after stimulation on DRC in clone RRRI 105 under \( \frac{1}{2} S \ d/4 \ 6d/7 \) tapping system (mean of six trees ± SE).
3.5.3. Latex sucrose

Control and stimulated
Maximum sucrose content in latex was observed on third tapping after stimulation. No change in sucrose was observed up to second tapping (Fig-27)

Stimulation and intensive tapping
An increase in latex sucrose was observed up to fourth intensive tapping and then decreases in subsequent tappings but higher than control (Fig-28)

Stimulation and tapping rest
Six day rested trees have maximum latex sucrose and then decreases. Sucrose content in trees was very low (Fig-29)

Fig-27 Effect of stimulation on latex sucrose in clone RRII 105 under 1/2 S d/4 6d/7 tapping system (mean of six trees ± SE)
Fig-28. Effect of intensive tapping after stimulation on latex sucrose in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ±SE)

Fig-29. Effect of tapping rest after stimulation on latex sucrose in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ±SE)
3.5.4. C-SUCROSE

Control and stimulated
An increase in sucrose in C-serum was observed up to third tapping and then decreases in stimulated trees (Fig-30).

Stimulation and intensive tapping
A general increase was observed and maximum sucrose content was on third intensive tapping after stimulation (Fig-31).

Stimulation and tapping rest
An increase was observed in C-serum sucrose up to six day rested trees and then decreases in 10 day rested trees after stimulation (Fig-32)

Fig- 30. Effect of stimulation on sucrose (C-serum) in clone RRII 105 under ½ S d/4 6d/7 tapping system (mean of six trees ± SE).
d/4-c: control d/4-s: stimulated
Fig-31  Effect of intensive tapping after stimulation on sucrose (C-serum) in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ±SE)

Fig-32  Effect of tapping rest after stimulation on sucrose (C-serum) in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)
3.5.5. Invertase activity in C-serum

Control and stimulated

No difference was observed in invertase activity between control and stimulated trees up to 2nd tapping after stimulation, then stimulated trees showed an increase on 3rd tapping after stimulation (Fig-33).

Stimulation and intensive tapping

The activity of invertase showed a decrease up to fourth intensive tapping after stimulation and then increases (Fig-34).

Stimulation and tapping rest

Activity of invertase in 2 and 6 day rested trees showed a decrease and then an increase was observed in 10 and 14 day rested trees (Fig-35).

Fig-33  Effect of stimulation on invertase activity of C-serum of clone RRII 105 under ½ S d/4 6d/7 tapping system (mean of six trees ±SE)  d/4-c: control  d/4-s: stimulated
Fig. 34 Effect of intensive tapping after stimulation on C-serum invertase in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ±SE)

Fig. 35 Effect of tapping rest after stimulation on invertase C-serum in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ±SE)
3.5.6. Sucrose synthase in C-serum

Control and stimulated

No difference was observed in the activity up to first tapping after stimulation. Then an increase was noticed in successive tappings (fig-36).

Stimulation and intensive tapping

Sucrose synthase activity showed an increase up to fourth intensive tapping (Fig-37).

Stimulation and tapping rest

Sucrose synthase activity decreases in two day rested trees and six day rested trees and then no variation was observed in 10 and 14 day rested trees.

Fig-36. Effect of stimulation on sucrose synthase activity in clone RRII 105 under ½ S d/2 6d/7 tapping system (mean of six trees ± SE)
Fig. 37 Effect of intensive tapping after stimulation on C-serum sucrose synthase in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)

Fig. 38 Effect of tapping rest after stimulation on C-serum sucrose synthase in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)
3.5.7 LATEX THIOLS

Control and stimulated

Latex thiol shows an overall increase in stimulated trees when compared to control trees on all tapping days (Fig-39).

Stimulation and intensive tapping

There was a general increase in latex thiol in trees with intensive tapping after stimulation. Maximum increase was on third intensive tapping (Fig-40).

Stimulation and tapping rest

An overall increase in latex thiol was observed in trees with different periods of rest and stimulation (Fig-41).

Fig-39. Effect of stimulation on latex thiols in clone RRII 105 under ½ S d/2 6d/7 tapping system. (mean of six trees ± SE)
Fig. 40 Effect of intensive tapping after stimulation on latex thiols in clone RRI 105 under ½ S d/4 6d/7 tapping system (mean of six trees ± SE)

Fig. 41 Effect of tapping rest after stimulation on latex thiols in clone RRII under ½ S d/4 6d/7 tapping system (mean of six trees ± SE)
3.5.8. Pi in Latex

Control and stimulated

Latex Pi showed an increase after first tapping in stimulated trees when compared to control trees (Fig-42).

Stimulation and intensive tapping

A general increase was observed after stimulation on all tapping days (Fig-43).

Stimulation and tapping rest

Maximum Pi was observed on 6 and 10 day rested trees. On 14 day rest a sudden decline was observed (Fig-44).

Fig-42. Effect of stimulation on Pi (latex) in clone RRII 105 under ½ S d/4 6d/7 tapping system (mean of six trees ±SE) d/4-c: control d/4-s: stimulated
Fig 43. Effect of intensive tapping on latex Pi in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)

Fig 44. Effect of tapping rest after stimulation on latex Pi in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)
3.5.9. Inorganic phosphorus in C-serum

Control and stimulated

No variation was observed in the content of inorganic phosphorus in stimulated trees when compared to control trees (Fig-45).

Stimulation and intensive tapping

A general increase in phosphorus content of C-serum was observed on all intensive tapping days after stimulation. Maximum increase was on fifth and sixth intensive tapping (Fig-46).

Stimulation and tapping rest

Up to six day rest, no variation was observed in the content of inorganic phosphorus and then a sudden increase was observed in trees with 10 and 14 day rest (Fig-47).

Fig- 45. Effect of stimulation on C-serum Pi in clone RRII 105 under ½ Sd/4 6d/7 tapping system (mean of six trees ±SE). d/4-c: control  d/4-s: stimulated
Fig-46: Effect of intensive tapping after stimulation on Pi (C-serum) in clone RRII 105 under 1/2 S d/4 6d/7 tapping system (mean of six trees ± SE)

Fig-47: Effect of tapping rest after stimulation on C-serum Pi in clone RRII 105 under 1/2 S d/4 6d/7 tapping system (mean of six trees ± SE)
3.5.10. Pi in B-serum

Control and stimulated
A general increase in Pi of B-serum was observed in stimulated trees when compared to control trees (Fig-48).

Stimulation and intensive tapping
Pi of B-serum showed an increase in first intensive tapping after stimulation and then a sudden decrease was observed in second intensive tapping (Fig-49).

Stimulation and tapping rest
Trees with 2 day rest showed an increase in Pi of B-serum. Then a gradual decrease was observed in 6,10 &14 day rest (Fig-50).

![Graph showing effect of stimulation on B-serum Pi in clone RRII 105 under 1/2 S d/4 6d/7 tapping system. (Mean of six trees ±SE).](image)
Fig. 49. Effect of intensive tapping after stimulation on b-serum Pi in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)

Fig. 50. Effect of tapping rest after stimulation on b-serum Pi in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)
3.5.11. Pyrophosphatase (C-serum)

Control and stimulated

Pyrophosphatase activity in C-serum increased on all tapping days after stimulation when compared to control (Fig-51).

Stimulation and intensive tapping

No variation in pyrophosphatase activity was observed in C-serum after stimulation and intensive tapping (Fig-52).

Stimulation and tapping rest

No variation in pyrophosphatase activity was observed in C-serum after stimulation and tapping rest (Fig-53).

![Graph showing pyrophosphatase activity](image)

Fig-51. Effect of stimulation on pyrophosphatase (C-serum) in clone RR11 105 under 1/2 5d/4 6d/7 tapping system (mean of six trees ±SE) d/4-c: control d/4-s-stimulated
Fig-52. Effect of intensive tapping after stimulation on pyrophosphatase activity (C-serum) in clone RRII 106 under 1/2 S d/4 6d/7 tapping system (mean of six trees ± SE)

Fig-53. Effect of tapping rest after stimulation on pyrophosphatase activity (C-serum) in clone RRII 106 under 1/2 S d/4 6d/7 tapping system (mean of six trees ± SE)
3.5.12. Latex pH

Control and stimulated

Latex pH after stimulation showed an increase up to third tapping and then decreases (Fig-54).

Stimulation and intensive tapping

Latex pH showed a general increase on all tapping days after stimulation (Fig-55).

Stimulation and tapping rest

No consistent variation was observed in the pH of latex in trees with different periods of tapping rest (Fig-56).

Fig-54. Effect of stimulation on latex pH in clone RRII 105 under $\frac{1}{2} S d/4 6d/7$ tapping system (mean of six trees ±SE).
  d/4-c: control  d/4-s: stimulated
Fig-55. Effect of intensive tapping on latex pH in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)

Fig-56. Effect of tapping rest after stimulation on latex pH in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)
3.5.13. C-SERUM PH

Control and stimulated

Stimulated trees showed an increase in pH of C-serum on all tapping days (Fig-57).

Stimulation and intensive tapping

A general increase in pH of C-serum was observed on all intensive tapping days (Fig-58)

Stimulation and tapping rest

No consistent variation pH of C-serum was observed in trees after tapping rest (Fig-59)

Fig- 57. Effect of stimulation on pH (C-serum) in clone RRII 105 under ½ S d/4 6d/7 tapping system (mean of six trees ±SE). d/4-c: control d/4-s: stimulated
Sequential tapping

Fig. 68 Effect of intensive tapping after stimulation on pH (C-serum) in clone RR11 106 under 1/2 5d/4 6d/7 tapping system (mean of six trees ±SE)

Tapping rest after stimulation (days)

Fig. 69 Effect of tapping rest after stimulation on pH (C-serum) in clone RR11 105 under 1/2 5d/4 6d/7 tapping system (mean of six trees ± SE)
3.5. 14. pH of B-serum

Control and stimulated

A general increase in pH of B-serum was observed in stimulated trees up to third tapping. Then a decrease in pH was observed (Fig-60).

Stimulation and intensive tapping

Maximum B-serum pH was observed on second intensive tapping after stimulation and then decreases (Fig-61).

Stimulation and tapping rest

pH of B-serum showed a decrease in trees with 2 day rest and an increase was observed in 6, 10, and 14 day rest trees. (Fig-62).

Fig- 60. Effect of stimulation on pH of B-serum in clone RRII 105 under ½ S d/4 6d/7 tapping system (mean of six trees ±SE)

* d/4-c: control    d/4-s: stimulated
Fig. 61. Effect of intensive tapping on b-serum pH in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE).

Fig. 62. Effect of tapping rest after stimulation on b-serum pH in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE).
3.5.15. ATPase activity of lutoids

Control and stimulated

ATPase activity in lutoids increased on all tapping days after stimulation (Fig-63).

Stimulation and intensive tapping

Maximum ATPase activity was observed on third intensive tapping. Then a decreased in the activity was observed on subsequent tappings (Fig-64).

Stimulation and tapping rest

A general increase in ATPase activity was observed in trees with different periods of tapping rest after stimulation. Maximum activity was observed on sixth day rested trees (Fig-65)

Fig-63. Effect of stimulation on ATPase activity of lutoids of clone RRII-105 under ½ S d/4 6d/7 tapping system (mean of six trees ±SE)

d/4-c: control          d/4-s: stimulated
Fig-64. Effect of intensive tapping after stimulation on ATPase activity in clone RRII 105 under 1/2 S d/4 6d/7 tapping system (mean of six trees ± SE)

Fig-65 Effect of tapping rest after stimulation on ATPase activity in clone RRII 105 under 1/2 S d/4 6d/7 tapping system (mean of six trees ± SE)
3.5.16. Bursting Index

Control and stimulated

A decreased BI was observed in stimulated trees after the first tapping when compared to control trees (Fig-66).

Stimulation and intensive tapping

The bursting index showed an increase up to third intensive tapping and then decreases (Fig-67).

Stimulation and tapping rest

The bursting index showed a decrease in trees with 2 day and 6 day rested trees (minimum) and showed an increase for 10 day and 14 day rested trees. (Fig-68)

---

**Fig- 66.** Effect of stimulation on bursting index in clone RR1105 under \( \frac{1}{2} S \ d/4 \ 6d/7 \) tapping system (mean of six trees ± SE) d/4-c: control d/4-s: stimulated
Fig-67 Effect of intensive tapping after stimulation on bursting index in clone RRII 105 under $\frac{1}{2} S d/4 6d/7$ tapping system (mean of six trees ±SE)

Fig-68 Effect of tapping rest after stimulation on bursting index in clone RRII 105 under $\frac{1}{2} S d/4 6d/7$ tapping system (mean of six trees ±SE)
3.5.17. Quantity of bottom fraction in latex

Control and stimulated

A high bottom fraction was observed on all tapping days in stimulated trees when compared to control trees (Fig-69).

Stimulation and intensive tapping

A general increase in bottom fraction was observed on all intensive tapping days after stimulation. Maximum increase was on fourth intensive tapping (Fig-70).

Stimulation and tapping rest

A slight increase in bottom fraction was observed in trees with 2 day rest and 6 day rest. Trees with 10 & 14 day rest showed a slight decrease.(Fig-71)

---

Fig. 69. Effect of stimulation on bottom fraction in latex in clone RRII 105 under ½ Sd/4 6d/7 tapping system (mean of six trees ±SE) d/4-c: control d/4-s-stimulated
Fig. 70. Effect of intensive tapping after stimulation on weight of bottom fraction in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)

Fig. 71. Effect of tapping rest after stimulation on weight of bottom fraction in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)
3.5.18. Volume of C- serum in latex

Control and stimulated

Volume of C-serum was less than that of control trees on all tapping days (Fig-72).

Stimulation and intensive tapping

Volume of C-serum decreases on all intensive tapping days after stimulation (Fig-73).

Stimulation and tapping rest

Volume of C-serum was decreased in trees with different periods of tapping rest after stimulation (Fig-74).

Fig- 72. Effect of stimulation on volume of C- serum in clone RRII 105 under ½ S d/4 6d/7 tapping system (mean of six trees ±SE)

d/4-c: control  d/4-s: stimulated
Fig-73. Effect of intensivetapping after stimulation on volume of C-serum in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)

Fig-74. Effect of tapping rest after stimulation on volume of C-serum in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)
3.5.19. Weight of cream in latex

**Control and stimulated**

No variation was observed in the weight of cream in stimulated trees when compared to control trees (Fig-75).

**Stimulation and intensive tapping**

A general decrease in the weight of cream up to fifth intensive tapping and then decreases (Fig-76).

**Stimulation and tapping rest**

Weight of cream in latex was increased up to six day rest and then no consistent variation was observed in trees with 10&14 day rest (Fig-77).

Fig-75. Effect of stimulation on wt. of cream in clone RRII 105under ½ S d/4 6d/7 tapping system (mean of six trees ±SE). d/4-c: control d/4-s: stimulated
Fig. 76. Effect of intensive tapping after stimulation on wt. of cream in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)

Fig. 77. Effect of tapping rest after stimulation on wt. of cream in clone RRII 105 under 1/2 Sd/4 6d/7 tapping system (mean of six trees ± SE)
3.5.20. N-acetyl glucosaminidase in B-serum

Control and stimulated

A decrease in activity of N-acetyl glucosaminidase was observed in stimulated trees on all tapping days (Fig-78).

Stimulation and intensive tapping

Activity decreases up to fourth intensive tapping after stimulation and then increases (Fig-79).

Stimulation and tapping rest

The activity showed no variation up to six day rest trees and then decreases on tenth day and increases on 14 day rested trees (Fig-80).

Fig 78. Effect of stimulation on N-acetyl glucosaminidase in B-serum in clone RRII 105 under 1/2S d/4 6d/7 system of tapping (mean of six trees ±SE), d/4-c: control  d/4-s: stimulated
Fig 79  Effect of intensive tapping after stimulation on b-serum N-acetyl glucosaminidase sucrose synthase in clone RRII 105 under 1/2 Sd/4 Std/7 tapping system (mean of six trees ±SE)

Fig 80  Effect of tapping rest after stimulation on b-serum N-acetyl glucosaminidase sucrose synthase in clone RRII 105 under 1/2 Sd/4 Std/7 tapping system (mean of six trees ±SE)
3.5.21 Glycolipids in latex

Control and stimulated
No change in glycolipids in latex was observed in first tapping after stimulation and then stimulated trees showed an increase in subsequent tappings (Fig-81).

Stimulation and intensive tapping
Glycolipids in latex was maximum on third intensive tapping after stimulation and then decreases (Fig-82)

Stimulation and tapping rest
Glycolipids in latex showed a slight increase in trees with 2d rest, then a gradual decrease in 6 and 10 day rested trees, then it remains same in 14 day rested trees (Fig-83)

Fig-81 Effect of stimulation on glycolipids in latex of clone RR11 105 under 1/2S D/4 6D/7 tapping system (mean±SE)
**Fig-82.** Effect of intensive tapping after stimulation on latex glycolipids in clone RRII 105 under 1/2 Sd/46d/7 tapping system (mean of six trees ±SE)

**Fig-83.** Effect of tapping rest after stimulation on latex glycolipids in clone RRII 105 under 1/2 S d/4 6d/7 tapping system (mean of six trees ±SE)
3.5.22. Phospholipids in latex

Control and stimulated
No change in phospholipids was observed in stimulated trees when compared to control trees (Fig-84)

Stimulation and intensive tapping
Maximum phospholipids was observed on second intensive tapping after stimulation and then decreases (Fig-85)

Stimulation and tapping rest
A gradual decrease in phospholipids was observed in trees with 2, 6, 10 and 14 day rest (Fig-86)

Fig-84. Effect of stimulation on phospholipids in clone RRll 105 under 1/2 S d/4 Sd/7 tapping system (mean of six trees ±SE)
Fig- 85  Effect of intensive tapping after stimulation on phospholipids in clone RRII 105 in clone RRII 105 under 1/2S d/4 6d/7 tapping system

Fig- 86. Effect of tapping rest after stimulation on phospholipids in clone RRII 105 under 1/2 S d/4 6d/7 tapping system (mean of six trees ± SE)
3.6. Biochemical parameters related to carbohydrate metabolism in trees affected by TPD.

It was found that two trees became partially dry (35%) after two years of opening. Basic parameters related to carbohydrate metabolism were done in the latex of these trees. Mean of ten healthy trees was taken as control. These two trees after one year became fully dry (100%). The bark samples were used for biochemical analysis. The trees were under 1/2 system of tapping.

The results are presented in this chapter. Yield of rubber prior to the appearance of partial dryness showed no change. After that the volume decreases in both trees when compared to healthy trees (Fig 87). Before the onset of TPD syndrome (35% dry) both trees showed a decrease in sucrose in C-serum and latex (Fig 88, 89). Then a sudden increase was observed after 6 months. Pi decrease after the development of TPD indicates very low metabolic rate (Fig. 90).

Bark analysis showed a high sucrose synthase activity in both TPD affected trees (Fig 94). Pi in bark of TPD tree No. 1 was lower and tree No. 2 was higher than that of control (Fig. 91). Sucrose and invertase activity of tree No. 1 was higher than that of control (92, 93). Sucrose and invertase activity of tree No 2 was lower than that of control. Low Pi in tree No.1 may reduce the metabolic activity even though sucrose and invertase were high.

Tree No. 1 showed a higher sucrose synthase activity, invertase activity, and sucrose in bark than tree No. 2. Pi of Tree 1 was lower than tree no. 2.
Fig. 37  Latex yield prior to the onset of partial dryness and after the incidence. Normal- mean values of ten healthy trees. Arrow shows the appearance of partial dryness. A- partial dry (pd) tree-1 and B- pd tree-2
Fig. 55 Sucrose content in C-serum prior to the onset of partial dryness and after the incidence. Normal- mean values of ten healthy trees. Arrow shows the appearance of partial dryness. A- partial dry (pd) tree-1 and B-pd tree-2.
Fig. 9: Sucrose content in latex prior to the onset of partial dryness and after the incidence. Normal- mean values of ten healthy trees. Arrow shows the appearance of partial dryness. A-partial dry (pd) tree-1 and B-pd tree-2
Fig 9c Phosphorus content in latex prior to the onset of partial dryness and after the incidence. Normal- mean values of ten healthy trees. Arrow shows the appearance of partial dryness. A- partial dry (pd) tree-1 and B- pd tree-2
Fig. 11 Phosphorus content in the bark of normal and TPD trees (1&2)
Fig. 9.2: Sucrose content in the bark of normal and TPD trees (1&2)
Fig. 4. Invertase activity in the bark of normal and TPD trees (1&2)
Sucrose synthase activity in the bark of normal and TPD trees (1&2)