SUMMARY

*Hevea brasiliensis* is the major commercial source of Natural Rubber (cis, 1,4 polyisoprene), which is obtained from the latex of this plant. Latex is the cytoplasm of specialised cells called laticifers. Upon tapping laticifers are severed and expels latex, which contains 30-60 % rubber. Besides rubber the latex contains various organelles including lutoids (single membrane bound microvacuoles with lysosomal characteristics). The production of rubber by the laticiferous system of *Hevea* depends on two major limiting factors. Latex flow after tapping and regeneration of the cell materials lost during tapping. Ecoclimatic conditions, water availability of the soil, defoliation, frequency of tapping and stimulant application in the bark of the tree to increase the rubber yield control or limit latex flow. Studies on physiological and biochemical mechanisms involved in the control and stopping of flow after tapping and latex regeneration are essential for optimisation of yield and to propose the most suitable tapping systems to growers. In view of the above, experiments were carried out to study (1) the seasonal variations in latex flow characters (2) variations in the physiological and biochemical parameters related to latex flow under high and low frequency tapping (3) Immediate effect of stimulation in the
latex flow characters and (4) Clonal variations in parameters associated with latex flow.

Under normal conditions, latex yield variation of rubber tree is a clonal character particularly during peak season. But during stress situations different factors contribute to yield variations. In the present study even though thiol metabolism is activated during stress, decline in cytosolic scavengers such as SOD and catalase leads to peroxidative degradation of membranes and lower yield. A decrease in latex ATP and ADP observed during stress indicate a lower activation of metabolism. Higher hevein, beta 1,3 glucanase and low N- acetyl glucosaminidase activities observed during stress indicate that under normal conditions hevein does not interact with rubber particles but during stress, due to high lutoid instability, the contents are released earlier into the cytosol and destabilize latex.

Tapping frequency has considerable influence on latex flow characteristics and biochemical parameters. In the present study, high yield was observed in high frequency tapped trees compared to unstimulated low frequency tapped trees. Different factors were limiting in high and low frequency-tapped trees. Under d/2 the limitation is the short interval between tappings and in d/4, the physiological and biochemical factors that cause high PI and BI. These factors include low thiol, SOD in C- and B- serum and high beta 1,3 glucanase activity in B-serum. Proteins removed during tapping are efficiently regenerated in d/4-tapped trees as evidenced by the increase in Glutamine synthetase activity.
Significant clonal variations were observed in the activities of SOD in C- and B- serum and glutathione reductase activity, which indicate active removal of toxic oxygen species and protection of membranes from peroxidative degradation. A high ATP content in high yielding clones indicate active metabolism.

In the present study associated changes after stimulation in low frequency tapped trees include a reduced BI, high ATP, thiol, Glutamine synthetase activity in C-serum, SOD in C- and B- serum and glutathione reductase. These are immediate changes and in the long term the effects may be different.

The present study also shows that regulation of enzymes such as SOD, glutathione reductase and glutamine synthetase is more important in latex flow characteristics particularly during stimulation. In intensively tapped trees, the draining of these enzymes are more and the rate of synthesis is not balanced with the rate of their removal. Excessive latex flow could produce physiological damages and trigger excessive loss of active materials from the latex vessel system.

In conditions where tapping rest is given after stimulation, the synthesis of these enzymes shut off after a period of six days since latex is not removed for a long time. These may be resynthesised quickly when it is needed. Regulation of enzymes is a key way of physiological balance regulation.

Results from all these studies bring out the importance of SOD, Glutathione reductase and thiols as important parameters in regulating latex flow. SOD is probably very important in lutoid stability and hence latex flow. The role of peroxidase is different; it does not act as an antioxidant in these situations.