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A RAPID AND NON DESTRUCTIVE METHOD TO ARRIVE AT LEAF WATER STATUS IN *HEVEA BRASILIENSIS*

Plant growth and various physiological processes are directly related to plant water stress than to soil water stress. Water fluxes within the plant have an impact on the distribution of nutrients and plant growth regulators. Measurement of water potential of plants is possible either with pressure chamber (Scholander *et al.*, 1965) or by using thermocouple psychrometer (Spanner, 1951; Montieth and Owen, 1958). However, these methods have limitations. Measurement of leaf water potential (ψl) of *Hevea* leaflets using pressure chamber is difficult because of the exudation of latex (Rao *et al.*, 1986). Frequent use of twigs from young plants for such measurements will reduce the leaf area of the plants by repeated sampling. Evidence of errors in pressure chamber estimates had also been reported (Ritchie and Hinckley, 1971; Pardossi *et al.*, 1991). Use of leaf discs in thermocouple psychrometer is time consuming due to long equilibration time required when ψl is low. Length of equilibration depends on the temperature differential between the samples and the chamber, water potential and physical nature of the sample. Liquid samples may require a few seconds whereas leaf samples require more time for equilibration (Anonymous, 1991).

Determination of latex vessel pressure potential (P lv) in the bark of the main trunk and measurement of osmotic potential of latex ($\psi \pi$) can be performed quickly (Buttery and Boatman, 1966; Devakumar *et al.*, 1988; Rao *et al.*, 1990). It was hypothesised that indirect derivation of bark water potential (ψ bark) from P lv and $\psi \pi$ would be the index to measure the plant moisture status and that it can be correlated to ψl.

The study was carried out during the dry months (February-March, 1992) using three year old *Hevea brasiliensis* plants (22 numbers) of clone RRII 105. The plants were raised in the experimental farm of the Rubber Research Institute of India following the recommended package of practices. Leaf water potential and latex solute potential were measured using C-52 sample chamber psychrometer connected to HR 33 Dew Point Microvoltmeter (Wescor Inc., Logan, USA). Equilibration time given for leaf discs in the sample chamber ranged from 30-45 minutes, whereas for the latex sample soaked filter paper discs it was only 5 minutes. Determination of Plv was done using disposable mini-manometers comprising no 48 polythene surgical tubing sealed at one end and fitted with 25 gauge hypodermic needle at the other (Devakumar *et al.*, 1988). All the measurements were made at two hour interval from pre-dawn to afternoon, on clear sunny days. Values of P lv, $\psi \pi$, ψl and ψ bark for the observation period are shown in Table 1. ψ bark was computed from Plv and $\psi \pi$ values. In this study, the highest leaf water potential recorded was 3.4 MPa. Kramer and Boyer (1996) also reported similar higher values.

Environmental factors like water and temperature affect tree physiology both directly and indirectly, most often in combination with other factors. Turgor pres-

Table 1. **Latex vessel pressure potential (P lv), osmotic potential of latex (ψ π), bark water potential (ψ bark) and leaf water potential (ψ l) in *Hevea brasiliensis***

P lv (+ MPa)	ψπ (-MPa)	ψ bark (-MPa)	ψ I (-MPa)
0.75	1.38	0.63	1.00
0.60	1.78	1.18	1.78
0.35	2.00	1.65	2.75
0.16	1.75	1.59	3.13
0.10	2.08	1.98	3.40
0.85	1.40	0.60	0.95
0.49	2.08	1.59	2.68
0.75	1.90	1.15	1.93
0.49	1.93	1.44	3.00
0.95	1.38	0.43	1.08
0.16	2.00	1.84	3.10
0.90	2.23	1.33	2.18
0.16	2.43	2.27	3.25
0.81	2.08	1.27	2.05
0.85	1.48	0.63	1.10
0.37	2.10	1.73	3.25
0.49	2.18	1.69	3.05
0.61	1.85	1.25	2.15
0.81	1.50	0.69	1.13
0.50	2.25	1.65	2.88
0.20	2.08	1.88	3.23.
0.25	2.03	1.78	3.10

sure and osmotic pressure of laticifer regulate the flow of water in and out of the latex vessels. Turgor pressure falls during the day as a result of loss of water due to transpiration. Clonal and seasonal variation in osmotic concentration of latex was reported by Satheesan *et al.* (1982) and in latex vessel turgor by Raghavendra *et al.* (1984).

Studies on water relations showed that maintenance of higher plant moisture status under drought conditions would lead to better yield performance in *Hevea brasiliensis* (Devakumar *et al.*, 1988). Determination of plant moisture status by measuring latex vessel turgor (manometry), latex

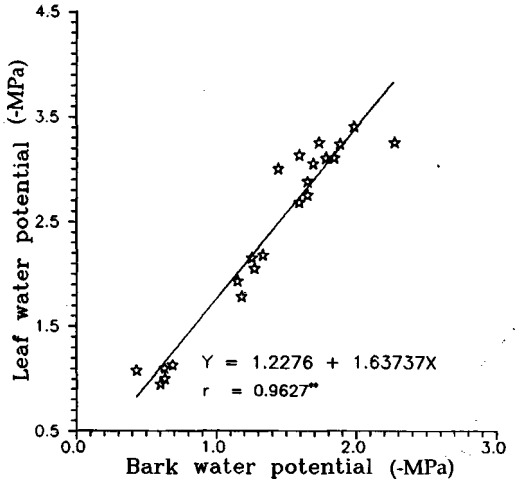

Fig. 1. Relationship between bark water potential (ψ bark) and leaf water potential (ψ l) in *Hevea brasiliensis*

** Significant at 1% level

solute potential (psychrometry) and deriving bark water potential does not require more than five minutes per plant. Moreover, it alleviates problems in leaf sampling from trees. Highly significant correlation was obtained between ψl and ψ bark (Fig. 1). Recording of plant moisture status in terms of bark water potential is rapid, easy and reliable. Therefore, this method can be used for rapid screening of a large number of samples.

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