

SOIL CO₂ FLUX MEASUREMENTS FROM A MATURE NATURAL RUBBER PLANTATION

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Soil CO₂ flux, also often referred as soil respiration is defined as the emission of CO₂ generated in the soil as a result of microbial and root activities. Soil CO₂ flux was measured and related to soil temperature and moisture in a 21 year old rubber plantation in central Kerala for a period of two years (June, 2010 to May, 2012). Measurements were made on an hourly basis for 272 days in the first year and 308 days in the second year. Soil respiration varied between the two years as well as between seasons in a given year due to variations in soil temperature and moisture. Total amount of CO₂ emitted was more in 2010-11 (26.1 tonnes ha⁻¹) than in 2011-12 (20.7 tonnes ha⁻¹) which was apparently related to more rainfall and number of rainy days in 2010-11 than in 2011-12. Soil respiration was slightly more in the night than in the day indicating that the cooler temperature of the night favoured more soil respiration. Soil respiration was higher during monsoon and summer seasons than during post monsoon and winter seasons in both the years. During monsoon, post monsoon, winter and summer seasons, the soil CO₂ fluxes were 2.21, 1.45, 1.47 and 2.19 $\mu\text{mol m}^{-2} \text{s}^{-1}$, respectively in 2010-11. In 2011-12, the soil CO₂ fluxes were 1.78, 1.15, 0.98 and 1.75 $\mu\text{mol m}^{-2} \text{s}^{-1}$ during monsoon, post monsoon, winter and summer seasons, respectively. In general, warmer temperatures favoured more soil respiration when sufficient moisture was available in the soil. When soil moisture status remained continuously high for longer periods, soil CO₂ fluxes were impaired. Sudden and intense rainfall during an otherwise relatively dry period led to voluminous eruption of CO₂ from soil as observed during many instances in winter and summer seasons in both the years. This may be due to burst of entrapped CO₂ in soil pores by rain water. Availability of moisture in soil was more critical than the soil temperature for soil respiration during summer whereas during wet periods, the soil temperature was more important. Rising temperature and changes in the amount and pattern of rainfall as a consequent effect of climate change may affect soil respiration rates which can have profound impact on global carbon cycle and also on soil organic matter, a key component that determines soil fertility.

Key words: *Hevea brasiliensis*, Climate change, Soil CO₂ flux, Soil respiration, Soil moisture, Soil temperature

INTRODUCTION

Soil respiration is a process by which the CO₂ generated by micro-organisms and roots in the soil is released to the atmosphere. Soils are the largest C pool in terrestrial ecosystems containing more than 1500 Pg C (Raich and Schlesinger, 1992; Eswaran *et al.*,

1993). Soil respiration exceeds all other terrestrial-atmospheric carbon exchange processes with the exception of photosynthesis (Xu and Shang, 2016; IPCC, 2001; Raich and Schlesinger, 1992). Carbon dioxide is a major greenhouse gas released from soil to atmosphere and it is a crucial component