PHOTOINHIBITION OF PHOTOSYNTHESIS OF HIGH GROWN TEA (*Camellia sinensis* L.O. KUNTZE) IN SRI LANKA WITH SPECIAL REFERENCE TO IRRADIANCE

By

PATABANDI MADDUMAGE ASHA SAJEEWANI KARUNARATNE

Thesis

Submitted in partial fulfillment of the requirements

for the degree of

MASTER OF PHILOSOPHY

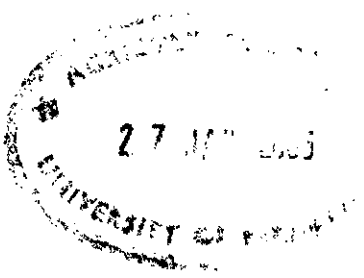
in the

POSTGRADUATE INSTITUTE OF AGRICULTURE

of the

UNIVERSITY OF PERADENIYA

PERADENIYA



JUNE 2004

ABSTRACT

The effect of Photosynthetically Active Radiation (PAR) on the rate of photosynthesis and chlorophyll fluorescence of field-grown mature tea (*Camellia sinensis* L.O.Kuntze) bushes in high elevation of Sri Lanka was extensively studied and characterized. Over a two year period the tea bushes were subjected to three shade treatments namely: artificial shade (approximately 30% shade, provided by black nylon netting), unshaded and shade tree (approximately 10% shade provided by *Grevillea robusta* L.). Leaf photosynthesis, related physiological and biochemical parameters and dry matter production of tea bushes exposed to different radiation intensities were monitored.

Physiological measurements were taken repeatedly on four different types of days representing bright, clear days, and cloudy conditions from dawn to dusk at two hour intervals. Rate of photosynthesis (A) and chlorophyll fluorescence of healthy, mature leaves on top of the canopy were related to the environmental conditions over the course of the day. Biochemical analysis for sugar and starch contents of the leaves measured for the above parameters was performed. The effect of radiation on productivity was assessed by dry matter yield.

On clear days, rate of photosynthesis (A) was greatest in the morning between 8:00 to 10:00 hour local time and gradually declined when the day progressed. There was a significantly ($p<0.05$) lower A in unshaded plants compared to the shaded. This drop in A of unshaded leaves could be attributed to photoinhibition of photosynthesis (PI).

Moreover, unshaded leaves had significantly lower ($p<0.05$) F_v/F_m around 9:00 to 11:00 hour local time compared to shaded plants clearly indicating the PI. This was further confirmed by the sugar content, which did not show any signs of accumulation at any time of the day. On cloudy days PI was not apparent. No relationship could be observed with the drop in *A* and leaf temperature and stomatal conductance.

However, the cumulative yield was significantly higher in tea under shade trees. The ultimate effect of the irradiance throughout the year is indicated in the yield. These data also confirms the importance of adherence to the recommended shade management practices in tea.

Key words: Tea, shade, chlorophyll fluorescence, photoinhibition, photosynthesis