

## Chlorophyll fluorescence characteristics of arecanut palms affected with yellow leaf disease\*

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Yellow leaf disease (YLD) of arecanut, a disease of mycoplasmal etiology (9), is a serious malady affecting the arecanut palms in Southern India. The diseased palms exhibit typical 'yellows' symptoms (8) wherein interveinal foliar yellowing starts from the tip of the leaflets of outerwhorls. Earlier studies on diseased palms have shown that the reduction in photosynthesis (A) is primarily due to mesophyll-limitation rather than stomatal-limitation of CO<sub>2</sub> movement (2). Fluorescence is closely related to the rate of carbon assimilation (6) and oxygen evolution (1, 10). Chlorophyll fluorescence characters were widely used to monitor changes in the activities and organization of photosynthetic apparatus in abiotically stressed plants (3). However, such changes were not reported in pathogen-induced stress during host-pathogen interactions. Hence, the present work was undertaken to examine fluorescence characteristics of arecanut palms affected with yellow leaf disease.

About 8-10 year old yellow leaf diseased palms showing symptoms of two different stages (4) viz., early disease (disease index score 1-20) and disease middle (severe infection) (disease index score, 21-40) as well as apparently healthy palms grown in a spacing of 2.7 × 2.7 m in a farmer's field at Sullia (disease-affected area)

and healthy palms raised in similar spacing in the Institute Farm at Vittal (disease-free area), Karnataka were used in the present experiments. In each case eight palms were used. Each palm was annually fertilized with 100 g N, 40 g P and 140 g K and irrigated weekly during summer months. The chlorophyll fluorescence induction characteristics were measured on the detached outer most leaf (2), after 30 min, dark adaptation using plant efficiency analyser (Hansatech, USA). The light source consists of six light emitting diodes (LED) emitting light peak at 650 nm resulting in 2400 μmol m<sup>-2</sup>s<sup>-1</sup> (photon flux density) on the leaf surface. The fluorescence induction curves and the various parameters such as initial fluorescence (F<sub>0</sub>), maximum fluorescence (F<sub>M</sub>), variable fluorescence (F<sub>V</sub>) and ratio of variable to maximum fluorescence (F<sub>V</sub>/F<sub>M</sub>) were recorded.

F<sub>0</sub> values were not affected in the leaves of diseased palms compared to apparently healthy palms (Table 1), presumably reflecting normality at the PS II pigment arrangement. F<sub>0</sub> is emitted mainly by chlorophyll molecules in the antennae pigments of PS II (7). The yellow leaf diseased palms exhibited lower F<sub>M</sub> values than those of apparently healthy palms at any given stage of the disease (Table 1). This reduced F<sub>M</sub> values in induced chlorophyll fluorescence of the leaves of the diseased palms suggesting the inhibition

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**Table 1 :** Chlorophyll fluorescence induction characteristics of apparently healthy and yellow leaf diseased palms (mean of 8 palms)

Parameters	Apparently healthy palms	Diseased Early infection	palms Middle (severe infection)	LSD (P = 0.01)
F <sub>O</sub>	678	698	604	NS
F <sub>M</sub>	3225	2544	1401	644
F <sub>V</sub>	2549	1846	837	629
F <sub>V</sub> /F <sub>M</sub>	0.789	0.681	0.544	0.007

Determinations were made on the outer leaf during October, 1992 between 10 h and 12 h.

of Q<sub>A</sub> reduction, a primary electron acceptor of PS II. Any decrease in the photoreduction activity of PS II will reduce values of F<sub>M</sub>(5). The ratio of F<sub>V</sub>/F<sub>M</sub> decreased in the diseased palms especially in middle stage (severe infection) by 31.1 per cent as compared to apparently healthy palms. This ratio is a quantitative measure of the potential photochemical efficiency of PS II and reliable indicator of the quantum yield photosynthetic O<sub>2</sub> evolution (1, 10). Similarly, a decrease in the F<sub>V</sub>/F<sub>M</sub> ratio has been reported in abiotically stressed plants (10).

The decrease in fluorescence indices (Table 1) in the leaves of diseased palms was concurrent with a reduction in chlorophylls and carotenoid pigments (Chowdappa *et al.*, unpublished). These changes result in reduction of the carboxylation efficiency reported in the yellow leaf diseased palms (2). Thus, these results suggest that overall efficiency of PS II was affected in the diseased palms.

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