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Changes in Leaf Construction Cost and Functional Traits of Two Tropical Dry Forest Species

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Abstract

The adaptation of plants to different light conditions in their environment at various stages of growth can be better understood through Leaf Construction Cost (LCC) and the associated leaf functional traits. In this study, we evaluated the LCC along with several leaf morphological and physiological traits of two tropical forest species, *Terminalia arjuna* and *Madhuca longifolia*. These traits included leaf nitrogen, phosphorous, protein, and ash contents, as well as heat of combustion (Hc), efficiency of photosystem ( $\Phi$ PSII), quantum yield (Fv/Fm), leaf mass per area (LMA), leaf dry matter content (LDMC), leaf vein density (VD), and leaf thickness (LT). The evaluation done in seedlings, saplings, and mature plants of these species, grown under two light levels (30% and 100%) to different heights (short, medium, and tall) in a shade house at the Faculty of Agriculture, Rajarata University of Sri Lanka. Our findings revealed that LMA ( $P < 0.01$ ), LDMC ( $P < 0.01$ ), and LCC ( $P < 0.01$ ) were significantly lower in saplings grown under 30% light conditions compared to seedlings grown under 100% light conditions. This suggests that leaves in low light conditions adjust their light interception and photosynthetic rates. Seedlings grown under 100% light conditions exhibited higher LT ( $P < 0.01$ ) and VD ( $P < 0.05$ ) compared to saplings grown under 30% light conditions. This indicates that to optimize growth rate and reduce investment in vascular tissues, saplings develop thin leaves with shorter water transportation distances. Mature plants, on the other hand, showed significantly lower nitrogen, protein, and phosphorous contents, which could be attributed to the presence of more dead tissues and a slower growth rate. Interestingly, mature trees exhibited significantly higher  $\Phi$ PSII and Fv/Fm, indicating their ability to withstand high photo inhibitory damages. By contrast, saplings had lower LCC due to lower Hc ( $P < 0.05$ ) and higher ash content ( $P < 0.01$ ). In conclusion, the LCC of these species aligns with a strategy of investing less and gaining more resources, as plants allocate their resources according to their functional requirements during their growth and development.

**Keywords:** Leaf mass per area, *Madhuca longifolia*, Nitrogen content, *Terminalia arjuna*, Vein density